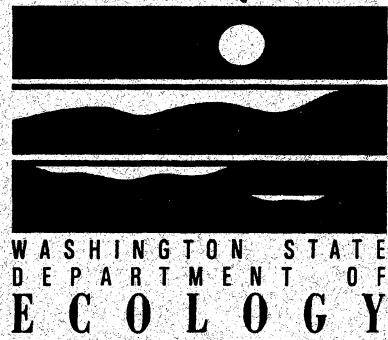


Natural Background Soil Metals Concentrations in Washington State

Toxics Cleanup Program
Department of Ecology



October, 1994
Publication #94-115



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Natural Background Soil Metals Concentrations

in

Washington State

by

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Toxics Cleanup Program
Olympia, Washington 98504-7600**

**Publication No. 94-115
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Executive Summary

This report contains information on the natural background concentrations of metals in surficial soil throughout Washington State. The objective of this study was to define a range of values that represent the natural concentration of metals in surficial soils throughout Washington. The results of this study represent the culmination of a seven-year effort by Ecology (Toxics Cleanup Program) and its co-sponsor, the USGS Water Resources Division (Tacoma Office).

Upon the completion of a small pilot project (Big Soos Creek Drainage Basin, King County, 1987), Washington was divided into 24 distinct regions based on differences in geology, soils, and climate (see **Figure 1**). Twelve of these 24 regions were then selected for a statewide assessment of Washington. These 12 regions were selected because they represent the major urban, industrial, and highly developed core areas in Washington, which is where most cleanup sites are located. Soil samples were then collected from the predominant soil series in each of the 12 regions, with a total of 490 soil samples collected from 166 locations throughout Washington. An effort was made to collect samples from undisturbed or undeveloped areas. Samples were collected from the "A," "B," and "C" soil horizons at each sampling location (ground surface to a depth of 3 ft.). Each sample was analyzed for total metals content.

The results of this study found that the soil metals concentrations in Western Washington were on average slightly higher than Eastern Washington. The population, climate, and vegetation of Western Washington are thought to be the primary reasons for this variation. The variation in west-to-east data are more pronounced when the 90th percentile values are compared (see **Table 1** below). The one exception was arsenic, whose east-side 90th percentile value was 13% higher than the west. Statewide and regional 90th percentile values are presented in **Table 1** below.

Table 1: Statewide & Regional 90th Percentile Values¹

	Al	As ²	Be	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Zn
State Wide	37,200	7	2	1	42	36	42,100	17	1,100	0.07	38	86
Puget Sound	32,600	7	0.6	1	48	36	58,700	24	1,200	0.07	48	85
Clark County	52,300	6	2	1	27	34	36,100	17	1,500	0.04	21	96
Yakima Basin	33,400	5	2	1	38	27	51,500	11	1,100	0.05	46	79
Spokane Basin	21,400	9	0.8	1	18	22	25,000	15	700	0.02	16	66

¹ All Values = mg/kg and represent total-recoverable analysis.

² Graphite furnace atomic absorption (GFAA) analysis.

I. OVERVIEW

Introduction

This report contains the results of a study of natural background soil metals concentrations in Washington State. In this study, 490 soil samples were collected from 166 sites throughout Washington. This study was conducted by the United States Geological Survey (USGS) in cooperation with the Department of Ecology, Toxics Cleanup Program.

What Does "Natural Background" Mean?

"Natural background" is defined in the Model Toxics Control Act (MTCA) (Ch 173-340-200 WAC) as the "...concentration of hazardous substance consistently present in the environment which has not been influenced by localized human activities. For example, several metals occur naturally in the bedrock and soil of Washington State due solely to the geologic processes that formed these materials and the concentration of these metals would be considered natural background. Also, low concentrations of some particularly persistent organic compounds such as polychlorinated biphenyls (PCBs) can be found in surficial soils and sediment throughout much of the state due to global use of these hazardous substances. These low concentrations would be considered natural background. Similarly, concentrations of various radionuclides which are present at low concentrations throughout the state due to global distribution of fallout from bomb testing and nuclear accidents would be considered natural background."

Why is this Study Important?

The advent of hazardous and toxic waste regulation in the United States has prompted a need for both the regulatory and industrial community to better understand the natural concentrations of certain elements in the environment. Consequently, many states, including Washington, have now begun to assess the natural concentration of metals in soils throughout their prospective regions. This study is important in that it represents a true benchmark of the natural background soil metals concentrations in Washington State. These data can be compared against data from known or suspected sites of environmental contamination. More informed decisions on site investigations, cleanup actions, and remedy selections can now be made as a result of the information from this study.

What are the Requirements for Background in the Model Toxics Control Act?

The requirements for determining natural background are given in Ch 173-340-708 (11) WAC of Washington's MTCA. Two types of background values may be determined--"area" and "natural." The derivation of natural background requires the collection of at least ten (10) samples, while the derivation of area background requires at least twenty (20) samples. Samples must be collected from areas that have the same basic characteristics as the medium of concern at the site. Samples must also be collected in areas that "...have not been influenced by releases from the site, and, in the case of natural background concentrations, have not been influenced by releases from other localized

human activities." Statistical methods and detailed guidance on how to derive background values are presented in the publication entitled *Statistical Guidance for Ecology Site Managers* (August, 1992). A computer software program known as "MTCAStat" (July 1993) can also be used to derive background values. Copies of the *Statistical Guidance for Site Managers* and MTCAStat can be obtained through the Ecology publications office (phone 206 407-7472).

How are Background Values Used?

Background values are often compared against a separate data set for regulatory or investigative purposes. Separate data sets can include data from site investigations, waste streams (sewage, sludge, incinerator ash, fill material), and other background studies. Once the data sets are compared, a decision is then made about whether the foreground data set exceeds the true range of values from the background data set. This decision is typically made using statistics or other mathematical procedures. A summary of potential users for the information from this study is given in Table 2 below.

Table 2: Anticipated Uses of the Background Soils Information

Task	Anticipated Users
Defining Background	Owner/operator of any site that does not want to complete a site-specific background study per MTCA requirements (using this data may be more cost-effective for smaller sites)
Risk Assessments	Toxicologists and other Scientists
Screening Data for Contamination	Ecology staff & Consultants
Analyzing Waste Streams	Generators of hazardous and solid waste, incinerator ash, fill material, and sewage sludge
Designing Investigative Studies	Consultants
Regulatory Compliance	Federal Programs including RCRA and Superfund, state biosolids and sewage sludge programs, health departments
Research	Universities and other organizations
General Information	Public, Attorneys, etc.

Background Soil Metals - Other Studies

The intent of this section is to provide some brief information on what other states and organizations have done regarding background investigations. It is hoped that this information can be used primarily for comparative purposes.

United States Geological Survey (USGS)

Schacklette and Boerngen (1984) of the USGS initiated one of the first studies of elements in soil throughout the United States. In their paper, Schacklette and Boerngen state that at the beginning of the study (1961), "...few data were available on the abundance of elements in surficial materials of the United States as a whole." They also went on to state that "...most of the early reports discussed only the elements that were of economic importance to mining or agriculture in a metallogenic area or State..." Thus, Shacklette designed a study to "...give estimates of the range of elemental abundance in surficial materials that were unaltered or very little unaltered from their natural condition." This led to the collection of soil samples from 1,318 sampling locations across the United States at depths of approximately 20 cm.

Washington

Increased awareness of environmental affairs and concern over industrial pollution in the United States has led to more need to understand the natural concentrations of certain elements in the environment. This trend has taken hold in Washington State, as noted by the 1989 PTI Environmental Services study entitled *Background Concentrations of Selected Chemicals in Water, Soil, Sediments, and Air of Washington State*. This study (performed by PTI for the Department of Ecology), was designed to identify "...the concentrations of high-priority contaminants that are representative of background (or ambient) conditions in the water, soil, and air of Washington state." The information from this study was ultimately used in the development of cleanup standards for the Model Toxics Control Act (MTCA).

The advent of hazardous waste regulation and cleanup of sites contaminated with toxic wastes in the United States has also prompted the need to understand the natural concentration of elements in the environment on a site-specific basis. A good example of this is the April 1993 study conducted by the United States Department of Energy for the Hanford Nuclear Reservation. This study involved the collection of over 180 soil samples at 14 locations throughout the Hanford site. Information from this study will ultimately be used in the environmental remediation and restoration effort at the Hanford site.

Similar site-specific investigations into background metals concentrations have been conducted at the Asarco Smelter Superfund site in Tacoma and the former Dupont Works site in Dupont. For the Asarco study, 25 samples were collected from McChord Air Force Base to determine the background concentrations of inorganics in soil (ICF & Ecology, April 1993). The natural or "ambient" concentration of arsenic in soil in and around the Asarco Smelter has been a high-priority item for several years now. A number of samples have also been collected to assess the natural concentration of mercury and other inorganic constituents at the Dupont site.

Michigan

The Michigan Department of Natural Resources (MDNR) completed a study of natural background soil metals concentrations in September 1988. An update to this study was completed in April 1991.

The background data from Michigan's study was originally intended for comparison against data from hazardous waste site closures (RCRA); however, the data set has been widely distributed and is currently being used at Michigan toxic waste cleanup sites as well. In Michigan, natural background values are generated by calculating the mean plus three standard deviations. For more information on the Michigan study, contact Dave Slayton, Senior Geologist, Geotechnical Unit, MDNR Waste Management Division at (517) 373-8012.

New Jersey

The New Jersey Department of Environmental Protection has published information available on the concentrations of metals and organics in soil at background locations throughout the state (ref; "A Summary of Selected Soil Constituents and Contaminants at Background Locations in New Jersey", New Jersey DEP, September, 1993). In this study, 80 soil samples were collected from 46 of the most common soil types found in New Jersey. Background concentrations are given according to five land use categories: urban, suburban, rural, golf course, and farm. Statistical or regulatory requirements for determining background are not given in the report; however, 90th percentile values are given for each land use category.

Ontario, Canada

A detailed and comprehensive assessment of background concentrations for both metals and organics in soil is given in Ontario's report entitled *Ontario Typical Range of Chemical Parameters in Soil, Vegetation, Moss Bags and Snow* (Ontario Ministry of Environment and Energy, December, 1993). Data on background soil metals concentrations have been compiled using the 98th percentile or Ontario Target Range (OTR₉₈). The 98th percentile was selected because it represents the mean plus two standard deviations of a normally distributed population. Ontario has also decided to divide background concentrations into ten land use categories, ranging from old urban residential to rural agricultural (data is currently available for only two land use categories: old urban and rural parkland). For more information, contact Lee Hoffman, PhD Toxicologist, Hazardous Contaminants Branch, at (416) 323-5118.

II. SOIL

What is Soil and How is it Formed?

There are several accepted definitions of soil. A simplistic definition for soil is "...that part of the regolith that can support rooted plants" (Flint, 1977). The term "regolith" literally means "blanket rock" and is defined as the unconsolidated portion of the earth's crust that overlies bedrock. Bushnell (1944) defined soil as a "...natural part of the earth's surface, being characterized by layers parallel to the surface resulting from modification of parent materials by physical, chemical, and biological processes operating under varying conditions during varying periods of time." Soil formation normally can be attributed to five factors: parent material, climate, topography, soil biota (i.e., vegetative cover), and time (Jenny, 1941).

Factors Affecting Soils Formation

The formation of soils is thought to be a weathering process (Thornes, 1979). Reiche (1950) and Keller (1957) defined weathering as "...the response of materials within the lithosphere to conditions at or near its contact with the atmosphere, the hydrosphere, and the biosphere." According to Jenny (1941), the formation and development of soils is controlled by five factors: parent material, climate, topography, soil biota (vegetation), and time. According to Flint (1971), "...the greatest differences among soils now forming are related to climate and vegetation." Specifically, changes in vegetation and soil weathering characteristics correspond to changes in climate and temperature. This trend can be observed across North America. For example, in the dry southwest, the warmer climate evaporates water more quickly, precipitating Ca^{2+} as a carbonate into the "B" soil horizon, producing alkaline conditions. Conversely, in the wet and cold northeast, soluble cations such as Ca^{2+} are transported readily into the soil horizon. The differences in climate and weathering processes in North America form the basis for two primary soil subdivisions: pedocals (calcium-rich, dryer climates) and pedalfers (higher amounts of clay and iron in the "B" horizon, wetter climates).

Washington Soils

The State of Washington is a geologically diverse land mass encompassing over 60,000 square miles. Geologic events over the last 200 million years have brought together several separated subcontinents into what is now Washington. Alt and Hyndman (1984) have since reclassified the State of Washington into six main geologic regions: Olympic Peninsula, Puget Sound Basin, Willapa Hills, Cascade Volcanics and North Cascades, Columbia Plateau, and Okanogan Subcontinent/Kootenay Arc areas.

Effect of Soil and Geologic Diversity on Background

For the purposes of this study, it was recognized that Washington is a geologically diverse state and that determination of background elements in surficial soils could be viewed with skepticism. However, it should again be noted that the formation and development of soils is a process that is

governed primarily by factors other than "geologic diversity;" i.e., the formation of soil is a weathering process affected largely by climate and vegetation. Thornbury (1969) illustrates this point by giving credit to two men, Dokuchaiev of Russia and Hilgard of America. Both of these men felt that given similar topographic, climatic, and vegetative conditions, the soil profile would

"...essentially be the same, regardless of variability in parent material." Thus, "geologic diversity" or "variability of parent rock material" may in some cases have minimal impact on the development and the elemental composition of soils. However, Thornbury (1969) also conceded that the thinking on the role of parent material is changing; i.e., "...no pedologist today would maintain that under similar environmental conditions a soil profile developed upon granite would ever be the same as that on limestone."

Summary

This study was designed to measure the background concentrations of metals in soil throughout Washington State. The effects of soil, climate, vegetation and geologic diversity and influences were recognized factors in the conception of this study; however, the definition and measurement of natural background was given top priority. Consequently, the true effects of soils, climate, and geologic diversity upon the results of this study have not been rigorously investigated. Ecology is hopeful that further research on the data from this study will be initiated at some future date.

III. STUDY DESIGN

Objective

The primary objective of this study was to define a range of values that represent the natural concentration of metals in surficial soils throughout Washington State. In order to meet this objective, the Department of Ecology entered into a joint funding agreement with the USGS Tacoma Office to study the ambient concentrations of metals in soils at a series of sites throughout Washington.

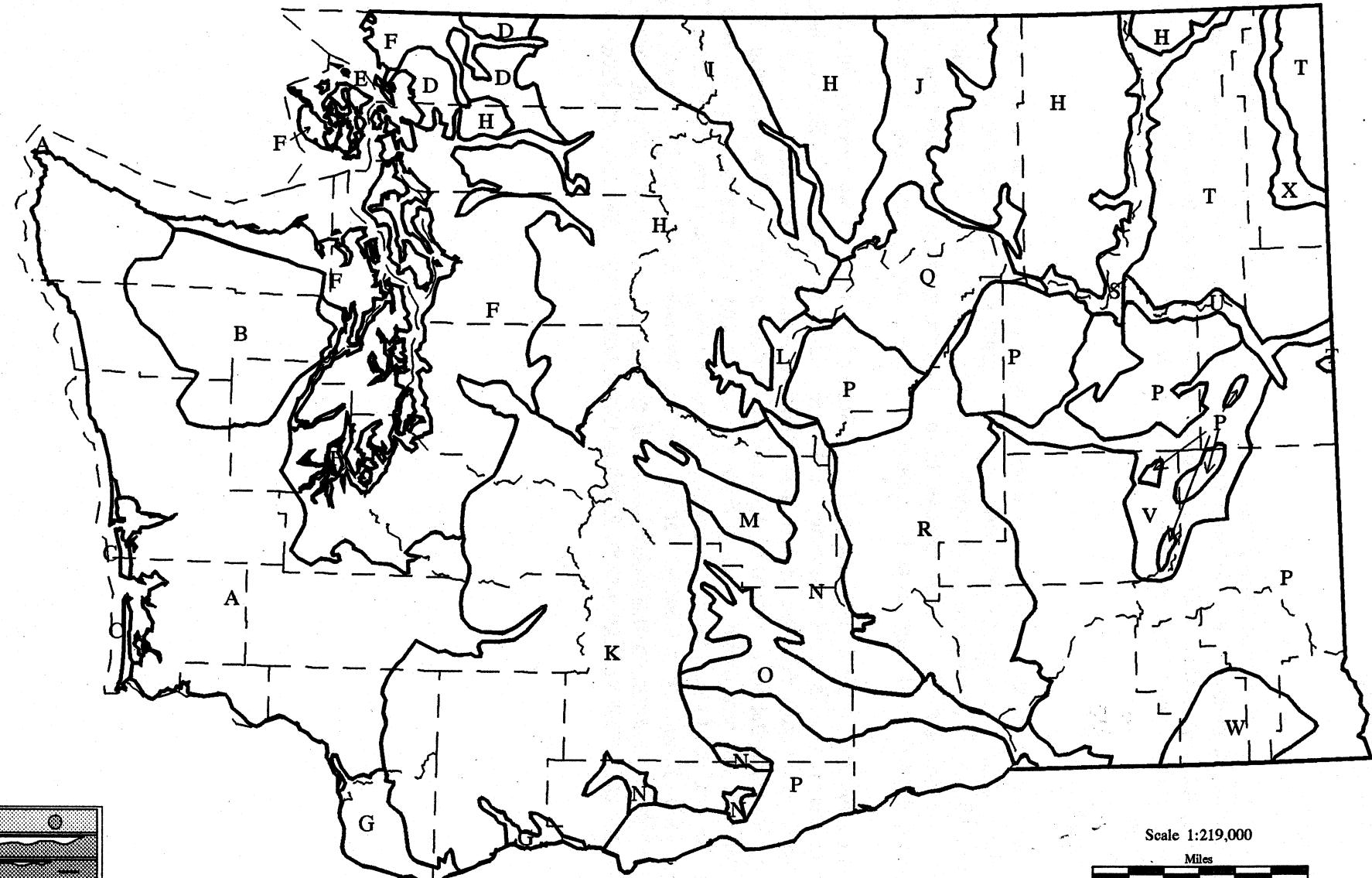
Approach

In order to meet the study objective, a small-to-large approach was taken in this study; i.e., a small test site was first investigated and larger areas were gradually added into the scope of work. Thus, the first site to be investigated was a small site in Western Washington known as the Big Soos Creek Drainage basin. This site, which occupies 15 to 30 square miles in southeast King County, was used for the collection of 41 samples at 18 separate locations at depths up to five (5) feet (1987).

Upon completion of the Soos Creek study, the State of Washington was divided into 24 distinct regions based on differences in geology, soils, and climate (see Figure 1). Each of these regions was selected by the USGS Water Resources Division. A decision was then made to select 12 of the 24 regions for a statewide natural background soil metals assessment of Washington. The predominant soil series within each of these 12 regions were then sampled (see Table 3). A decision was also made to focus additional sampling on the four large urban areas within these 12 regions: Puget Sound Basin, Clark County, Yakima, and the Spokane Basin. The 12 statewide regions and four major urban areas were selected because they represent the major urban, industrial, and highly developed core areas in Washington, which is where most toxic waste sites are located.

Figure 1: Soil Regions of Washington State

(See Table 3 for Regional Description)



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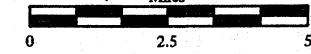


Table 3: Soil and Regional Geologic Descriptions, Statewide Natural Background Study.¹

Location & Soils Description		Soil Series & Geologic Origin
A	Southwest Washington (Willapa Hills). Developed mainly in continental and marine sedimentary beds along the Pacific Coast (Pringle, 1986). All soils sampled in this Region were developed on upland marine sediments.	Willapa: developed on marine terraces that were cut into marine sediments. Zenker: weathered sandstones. Melbourne: material weathered from marine-deposited siltstone, shale, and fine-grained sandstone.
C	Pacific Coast (Long Beach, Westport, Grays Harbor). Beach sands and "dune lands", i.e. excessively drained ridges formed in fine beach sands.	Netarts: upland areas. Yaquina: basin-like areas between sand dunes (Pringle, 1986).
D	Northern Skagit and Whatcom Counties, Mt. Baker Area. Developed in older sedimentary rocks on the west side of the Cascades (Poulson, 1953).	Cathcart: sandstones and shales. Heisler: glacial moraines in high mountain valleys west of Mt. Baker. Schnorbrush: arkosic sandstone and mountain-side drift material or talus rubble - Nooksack River valley.
F	Puget Sound Basin. Glacial Deposits (till, alluvium, etc.).	Everett: glacial outwash. Spanaway: glacial outwash + volcanic ash.
G	Vancouver-Clark County area. Alluvium derived from a variety of sources.	Lauren: mixed alluvium from Columbia River terraces 50 - 100 ft. above the present river elevation. Wind River: mixed alluvium 150 - 500 ft. above the present river elevation. Sauvie: alluvial bottom lands along the Columbia River. Dollar: terrace deposits. Gee: rolling hills on eroded terraces.
J	Unconsolidated deposits in the Okanogan River Valley.	Colville: mixed alluvium from igneous rocks and volcanic ash. Pouge: terrace deposits, underlain by gravelly sandstones that were deposited as glacial outwash. Cashmere: glacial outwash and more recent alluvium (Lenfesty, 1990)
L	Developed primarily from older sedimentary rocks in the Wenatchee River Valley.	Burch: older alluvium derived from sandstone.
M	Unconsolidated loess and alluvium of the Ellensburg Basin.	Renslow & Selah: loess with caliche layers, underlain by gravel and valley fill. Naches: older valley fill. Reeser: formed over cemented gravels. Wenas: stream bottom material from weathered basalt.
O	Yakima River valley.	Shano & Warden: loess underlain by glaciolacustrine sediments ("Touchet" beds). Weirman: mixed alluvium from flood plains
P	Lincoln-Douglas County area. Thick loess deposits.	Walla & Athena: loess + volcanic ash.
R	Central Columbia Basin. Unconsolidated wind-blown and alluvial material.	Quincy: eolian sands. Shano: loess + volcanic ash. Taunton: wind-worked alluvium.
U	Spokane River Valley.	Marble: wind-worked sandy outwash. Springdale: outwash mantled with volcanic ash and loess. Ewall & Spens: glacial outwash.

Note: the information in this table was taken from a report prepared by Kenneth C. Ames of the U.S. Geological Survey ("Concentrations of Metals in Soils From Selected Regions in the State of Washington". Draft report, subject to revisions).

IV. SAMPLING

All soil samples were collected by personnel from the USGS Water Resources Division. The Department of Ecology participated in sampling activities at a few locations. All sampling activities took place between June 1987 and January 1993. A brief description of each sampling area and sampling methodology is included in the summaries below. A summary of all sampling activities is presented in Table 4.

Soos Creek Basin, King County

Sixty (60) samples were collected during June 1987 from a 15.9 mi² area immediately north of the Big and Little Soos Creeks confluence. Five (5) sampling sites were located in the Big Soos Creek subbasin and another four (4) were located in the Little Soos Creek subbasin. One shallow sample (0.5 ft.) was collected from these nine locations. Three (3) stream sediment sampling sites were also located in these subbasins.

Deeper samples (i.e., 5-7 ft.) were collected at selected locations from a backhoe pit. Samples from the "B" and "C" soil horizons were then collected. Shallow samples (0.5 ft.) were collected after first removing the top 1-2" of soil, which contained plant debris and litter. Streamed samples were collected from the upper 1" of locations with fine-grained sand and silt. All of the samples were then sieved for laboratory analysis. For the total-recoverable method, the samples were sieved to particles sizes less than 2 mm.

Statewide Natural Background Assessment

The first phase of this work to be initiated consisted of the collection of sixty (60) samples from the 12 main geologic and urban regions within Washington (5 samples each from regions A, C, D, F, G, J, L, M, O, P, R, U, see Figure 2). The 12-region work was performed during July, August, and September 1990. All of the samples were collected from the "B" or "C" soil horizons that are typically found 2-3 ft. below ground surface. Samples were collected from this zone to minimize the potential effect posed by surface vegetative material on the sampling. The "B" and "C" soil horizons were also selected for sample collection for comparison purposes with toxic waste sites since many of these sites are located in areas where the topsoil has been removed or filled over.

The next phase of work in the statewide assessment involved the collection of samples from the four main urban areas within Washington: Clark County, Yakima Basin, Spokane Basin, and Puget Sound Basin. At each sampling location a shovel was used to dig a 2-ft. wide by 2-ft. deep hole. Each sampling location was consisted of five test pits; i.e., a 2 X 2 ft. test pit was dug at the center and each corner of a 1-acre plot (see Figure 3). A stainless-steel soil auger was then used to collect 1-2 liters of material from the bottom 6 inches of each test pit. Material from each of the five holes was sieved down to particles less than 19.0 mm in size and placed in a 20-liter plastic bucket. The soil samples were then thoroughly mixed to form one composite sample.

Figure 2: Soil Sampling Locations in Washington State

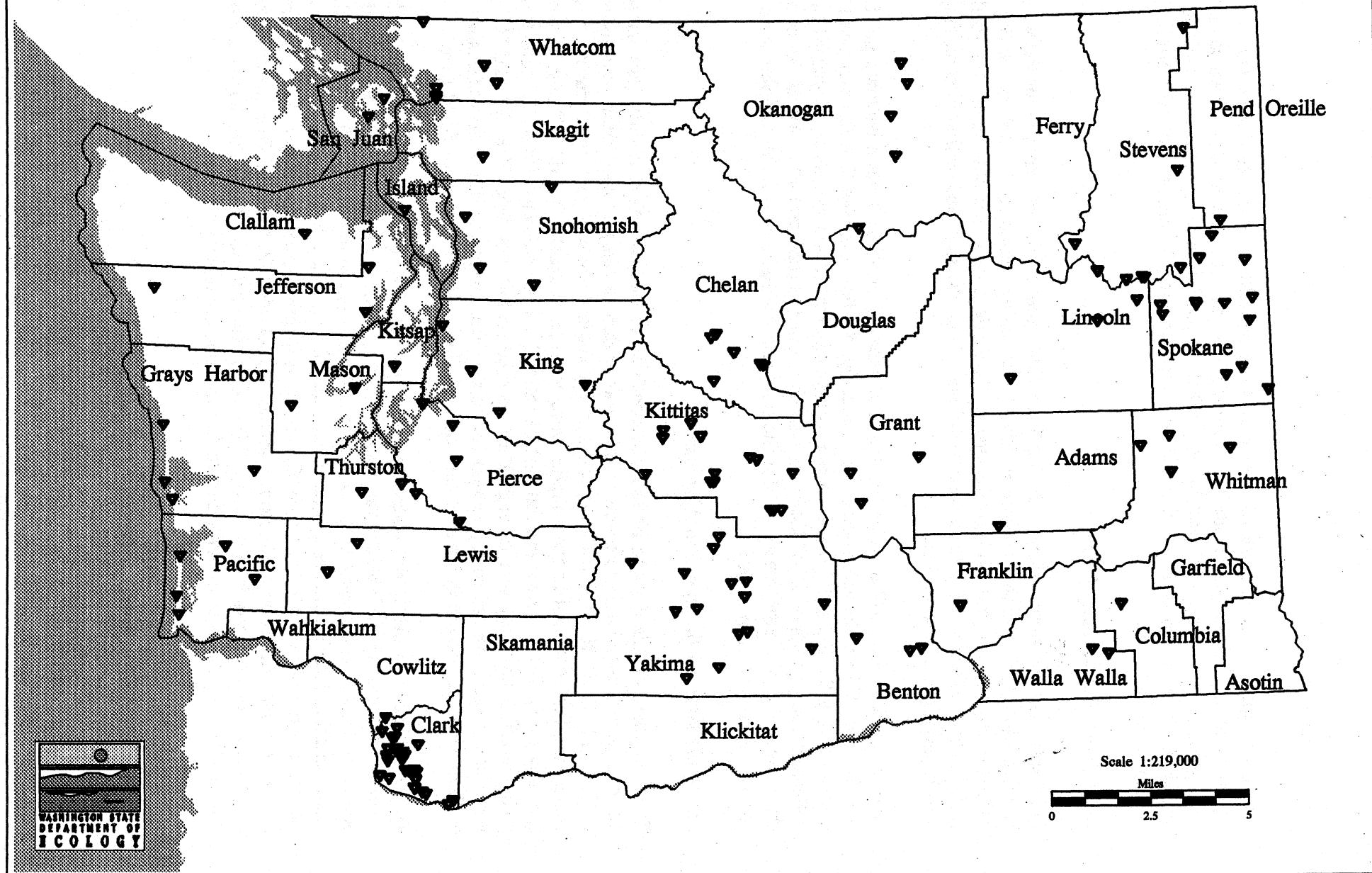


Table 4: Background Soil Metals Sampling Summary

Study	No. of Samples Collected	Sampling Locations	Sample Depths (in.)	Number of Samples Collected per Location	Sampling Procedures	Date
Soos Creek	41	18	up to 60	1-3	Pilot project for natural background study. One shallow sample (0.5 ft.) collected from 9 locations + 3 streambed sediment samples. Deeper samples (5-7 ft.) collected from backhoe pits.	1987
Twelve Region	60	60	20-34	1 (composite of 5 locations within a 1 acre area).	Samples collected from 12 geologically distinct regions in Washington (5 samples per region for a total of 60). Only surficial samples are collected: 2 ft. x 2 ft. test pit dug at the center and each corner of a 1 acre plot, see Figure: (five sampling test pits total). Stainless-steel augur used to collect 1-2 liters of soil from the bottom 6 inches of each test pit. Material from each test pit sieved to < 19.0 mm particle size and thoroughly mixed (composited) in a 20 liter plastic bucket. Soil is then sieved to less than 2 mm at Manchester Laboratory.	1990
Clark ¹ County	81	21	24-36	5 from Vertical Profile "A" 13 from Vertical Profile "B"	Two types of samples collected, surficial (see above description) and "vertical profile". Vertical profile samples were collected from a hand-dug test pit approximately 5-6 ft. deep. An effort is made to sample the "A", "B", and "C" soil horizons. <u>Vertical profile samples were not composited</u> . Two types of vertical profile sampling techniques were used. In Version "A", 5 samples were collected at vertical intervals (samples are collected by standing in the test pit and troweling soil from the "A", "B", and "C" soil horizons). In Version "B", 13 samples are collected; 5 samples are collected from the "center" hand-dug test pit and an additional 8 are collected from 4 sampling locations near the test pit (each corner of a 1-acre plot, 2 samples per location).	1991
Yakima ² Basin	107	22	24-36	5 from surficial, 5 or 13 from vertical profile.	Surficial (five samples collected from a 1 acre plot with a stainless-steel soil augur, 2 ft. depth) and vertical profile (5 or 13 samples collected from a hand-dug test pit, 5-6 ft. deep) samples collected. All samples field-sieved to < 19 mm.	1991
Spokane Basin ³	79	22	24-36	Same as above.	Same as above.	1992
Puget Sound Basin ⁴	122	23	24-36	Same as above.	Same as above.	1993
Total	490	166				

¹ Five (5) samples from Region "G" added for background calculations. ² Ten (10) samples (total) from Regions "M" and "O" added for background calculations. ³ Five (5) samples from Region "U" added for background calculations. ⁴ Five samples from Region "F" added for background calculations.

FIGURE 3: SURFICIAL SOIL SAMPLING SCHEME: 2 X 2 FT. TEST PIT HAND-DUG AT THE CENTER AND EACH CORNER OF A ONE ACRE PLOT. STAINLESS STEEL SOIL AUGER USED TO COLLECT 1-2 LITERS OF SOIL FROM THE BOTTOM 6" OF EACH HOLE. ALL 5 SAMPLES WERE THEN COMPOSITED TO FORM ONE SAMPLE.

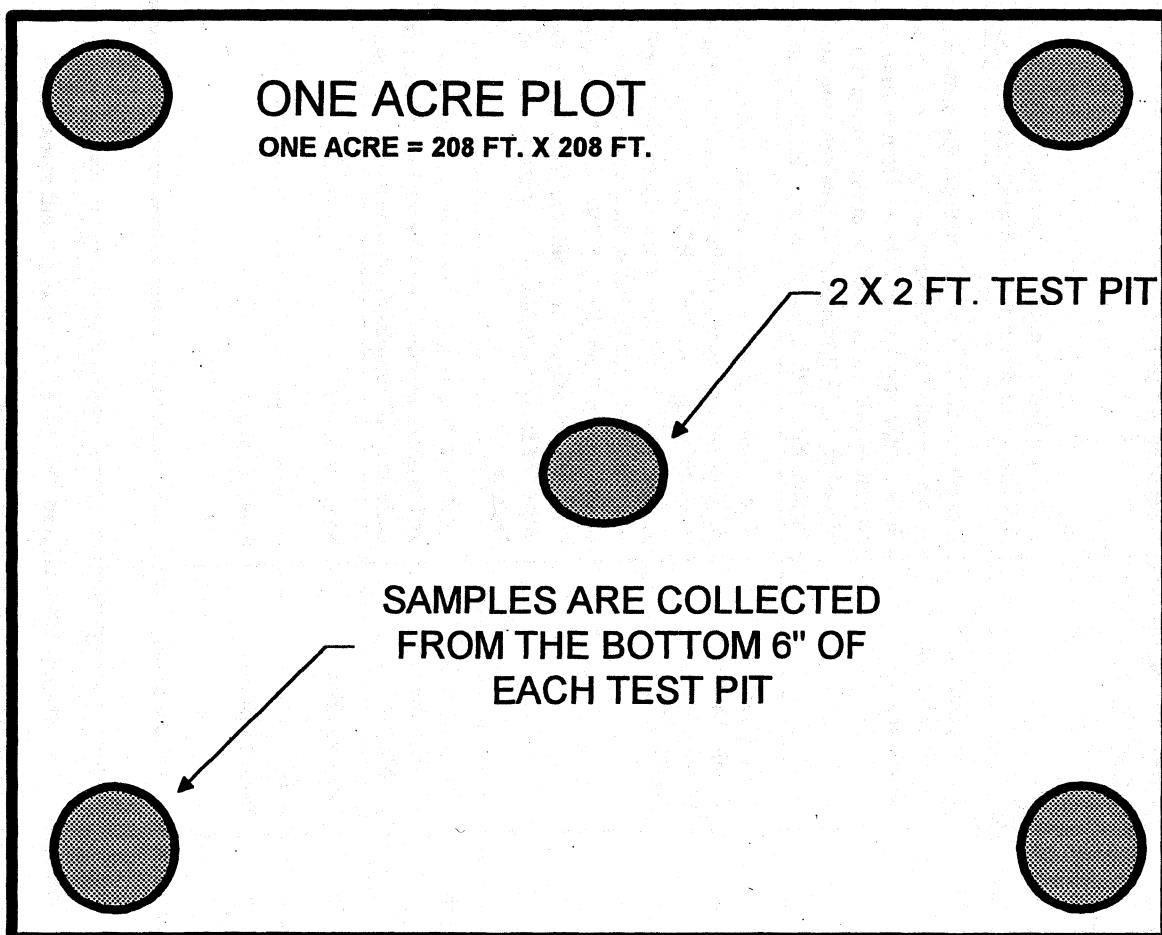
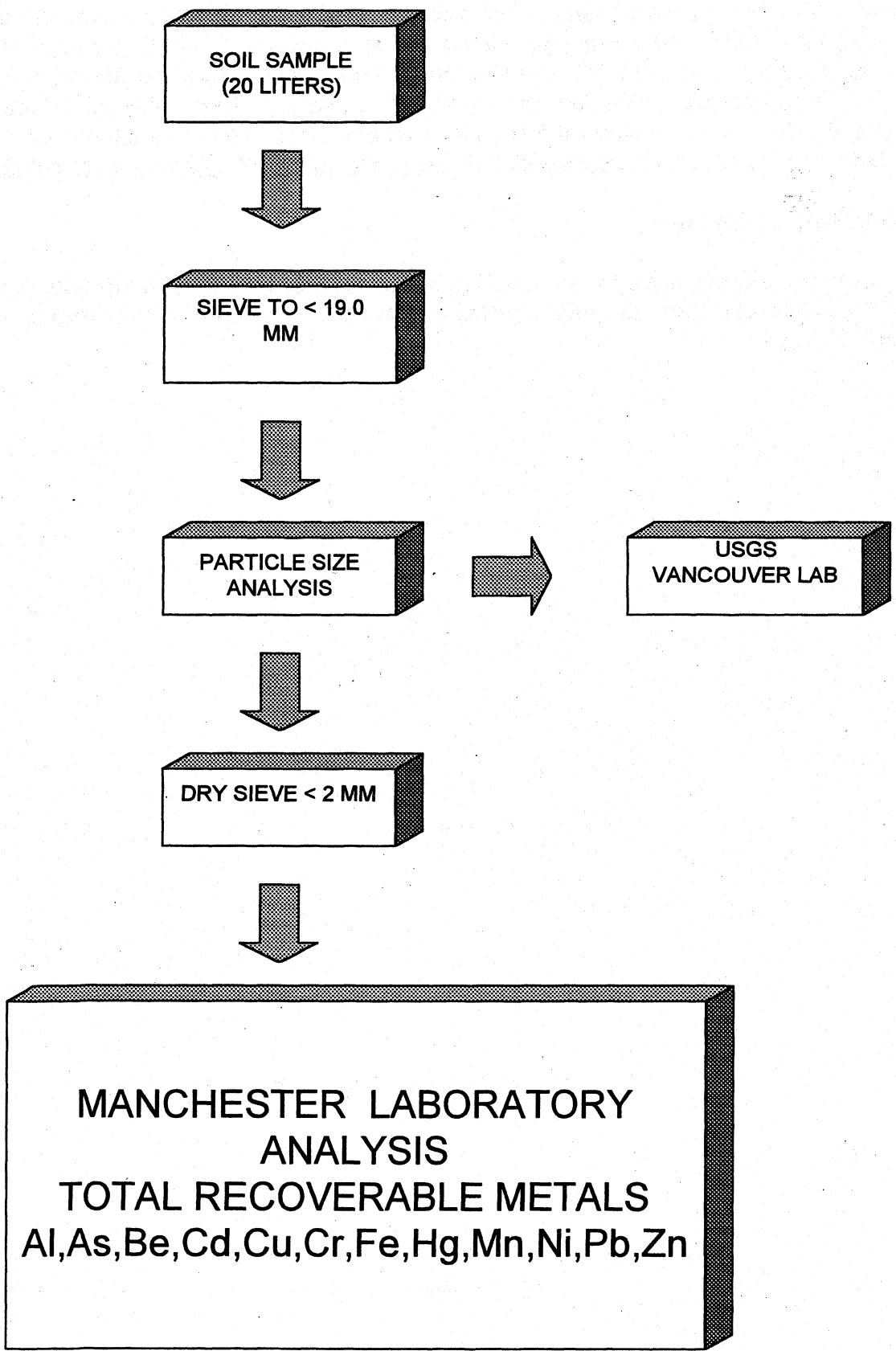


FIGURE 4: SOIL SAMPLE PREPARATION, BACKGROUND SOIL METALS PROJECT



Vertical Profile Samples

A second sampling procedure, known as "vertical profile" sampling, was also used in the statewide assessment study. Vertical profile samples were collected using the following procedure: a hand-dug hole located at the center of a 1-acre plot was completed to a depth of 5-6 ft.. Samples were then collected from the "A", "B", and "C" soil horizons. Two types of vertical profiles were used. In version "A", 5 samples were collected. In version "B", 13 samples were collected--5 from the center hand-dug hole and an additional 8 from four locations near the hole (each corner of a 1-acre plot; 2 samples per location). Samples collected from vertical profile locations were not composited.

Equipment Decontamination

Before and after collecting samples, all sampling equipment was washed with tap water and detergent (Alconox) and then sequentially rinsed with tap water, a 60/40 acetone/hexane solution, and deionized water.

V. ANALYSIS

Laboratory Analytical Procedures

All of the soil metals data presented in this report except for mercury, was generated by use of the "total recoverable" laboratory method; i.e., EPA Method 3050, Acid Digestion of Sediments, Sludges, and Soils. In this method, a representative (1-2 gram wet weight) sample is digested in nitric acid and hydrogen peroxide. The digestate is then refluxed with either nitric acid or hydrochloric acid. EPA Method 6010, Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP), is then used for analysis after the samples are digested and solubilized. This method measures element-emitted light by optical spectrometry (EPA SW-846, Test Method for Evaluating Solid Waste, Volume 1A, 1986). Mercury analysis was performed by using EPA Method 7471, Manual Cold-Vapor Technique. This technique is based on the atomic absorption of radiation at the 253.7-nm wavelength by mercury vapor. Because of the ability to produce lower detection limits, atomic absorption methods were also used to analyze arsenic and selenium (EPA Methods 7060 and 7740). A summary of all laboratory analytical methods is given in Table 5.

Grain Size

All of the samples sent to Manchester Laboratory were sieved to sizes less than 2 mm prior to analysis. This practice is consistent with Ch. 173-340-740 (7) WAC of the MTCA; i.e., compliance with soil cleanup levels shall be based on total analysis of the soil fraction less than 2 mm in size.

Table 5: Laboratory Analytical Methods Summary

Parameter	Test	Laboratory Methods	Laboratory
Metals ¹	Total Recoverable Metals	Samples are prepared using Method 3050 Acid Digestion of Sludges, Sediments, and Soils. Analysis is performed using EPA 6010, Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP).	Manchester
Metals ¹	Total-Total Metals	At least 95 percent of the solid material is digested using hydrochloric, nitric, hydrofluoric, and perchloric acids. Material is then solubilized and analyzed using ICP & AA techniques.	USGS Denver, Colorado (Arvada)
As	Graphite Furnace Atomic Absorption (GFAA)	EPA 7060 & 7740	Manchester
Hg	Cold Vapor	EPA 7471 Manual Cold-Vapor Technique	Manchester

¹ Al, As, Be, Cd, Cr, Cu, Fe, Mn, Ni, Pb, Zn

VI. STUDY RESULTS

Data Analysis

Since more than one sample was collected at many sampling locations, a decision was made to simply average all of the measured values per location, including sample splits and duplicates. For each of the twelve elements, one value is reported per sampling location. Thus, a sample population of 166 was used for the calculation of natural background values (166 sampling locations). One-half the detection limit value was also used for non-detect values, per MTCA specifications (Ch 173-340-708 (11)(e) WAC).

Calculation of Background Values

Ecology's MTCAStat program (MTCAStat is a software package developed for use with Microsoft Excel to meet the need for a fast, simple, integrated method of performing routine statistical analyses described in the statistical *Guidance for Ecology Site Managers*) was used to calculate 90th percentile values for 12 elements (Al, As, Be, Cd, Cr, Fe, Hg, Mg, Mn, Ni, Pb, Zn). The 90th percentile value is used by Ecology to calculate natural background values. Statewide and area or regional natural background values were calculated for Clark County, Puget Sound, Yakima, and Spokane. Statewide 90th percentile values are given in **Table 6** and **Figure 5**.

What is the 90th Percentile Value?

The 90th percentile is a value that 10% of a given data set will exceed (90th = 90% data below, 10% data above). Another way of thinking about the 90th percentile is you have a one-in-ten chance of having a sample that exceeds the specified concentration.

Why is this important?

Ecology uses the 90th percentile as the default value for background calculations. The 90th percentile value was selected as a result of Monte Carlo simulations of lognormal and normally distributed data (ref: *Statistical Guidance for Site Managers*). The 90th percentile is a conservative value; i.e., 10% of the data will exceed it. For example, in a normal distribution or bell-shaped curve, the 90th percentile is equal to 1.28 standard deviations from the mean. In the same distribution, the 95th percentile is equal to 1.96 standard deviations and the 99th percentile is equal to 3.0 standard deviations. Background values in some states such as Michigan, and in Ontario (Canada) are based on 99th and 98th percentile values (in a normal distribution, the 99th percentile = mean + 3 standard deviations, the 97.5 percentile = mean + 2 standard deviations).

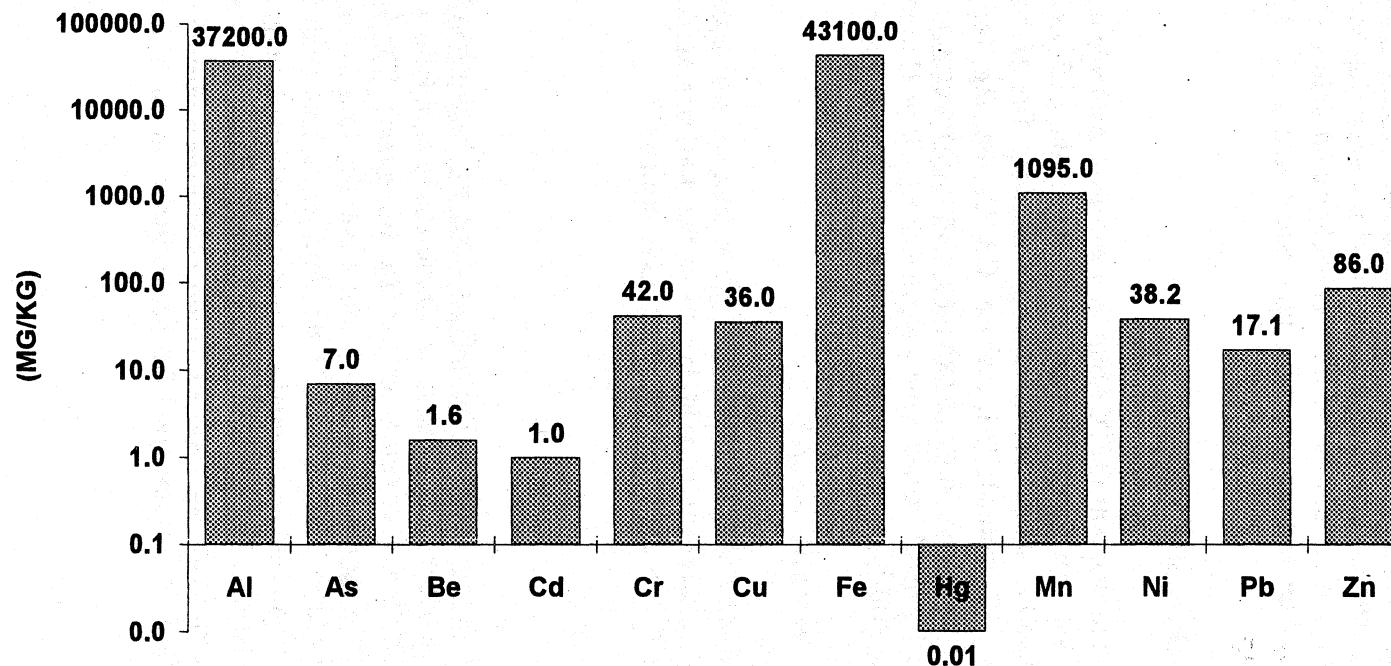
TABLE 6: STATEWIDE 90th PERCENTILE VALUES

SAMPLE POPULATION (n) = 166

Al	As	Be	Cd	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Zn
37200.0	7.0	1.6	1.0	42.0	36.0	43100.0	0.01	1095.0	38.2	17.1	86.0

All Values = mg/kg

FIGURE 5: STATEWIDE 90th PERCENTILE VALUES



Note: See Figure 47 for Ag, Ba, Ca, Co, Mg, Na, Sb, Se, Ti, & V 90th Percentile Values

90th Percentile Comparison

A summary comparison or 90th percentile values is given in **Table 7**. The sample population for each regional group is given in **Table 7** and **Figure 6**. When comparing 90th percentile values between data sets, the following observations were made:

- ▶ Five of the 13 maximum 90th percentile values came from one data set, Group "W" (Al, Cr, Cu, Hg, Ni). This occurrence is probably due to the smaller sample population (15) of Group "W" (note: Group "W" is comprised of Regions "A", "C", and "D" and encompasses that area outside of the Puget Sound Basin and Clark County regions);
- ▶ Conversely, seven of the minimum 90th percentile values came from one data set, Spokane Basin (Al, Cr, Cu, Fe, Hg, Ni, Zn). Additionally, when compared against other data sets, the Spokane data tended to have the least amount of variation from maximum to minimum values.
- ▶ The west-side 90th percentile values are on average 1.5 times higher than the east-side values (see **Table 8** and **Figures 7-9**). The lone exception to this was the east-side 90th percentile value for arsenic, which was 15% higher than the west-side value. The extremities in climate, vegetation, and geology between Western and Eastern Washington are thought to be the primary reasons for variations in the west/east 90th percentile values.

Background Values: Washington and Other States

A comparison of Washington's 90th percentile values to those from other states or other background studies is presented in **Table 9** and **Figure 10**. This comparison found that the background values identified in Washington are very similar to those detected in other states or other studies.

TABLE 7: COMPARISON OF 90th PERCENTILE VALUES

ALL VALUES = MG/KG

	n	AI	As AA	As ICP	Be	Cd	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Zn
GROUP "W"	15	62,905	8.47	N/A	0.75	0.10	78.46	52.85	49,170	0.13	691.75	54.19	10.87	85.56
PUGET SOUND	45	32,581	7.30	22.80	0.61	0.77	48.15	36.36	36,128	0.07	1,146.00	38.19	16.83	85.06
CLARK COUNTY	26	52,276	5.81	60.80	2.07	0.93	26.57	34.43	58,665	0.04	1,511.00	21.04	24.02	95.52
WEST (ALL)	86	45,735	6.37	46.21	1.51	1.20	47.40	43.23	50,125	0.08	1,337.27	44.20	20.42	98.39
STATEWIDE	166	37,206	6.99	41.81	1.44	0.99	41.88	36.01	43,106	0.07	1,094.85	38.19	17.09	85.82
EAST (ALL)	80	28,299	7.61	36.17	1.27	0.81	31.88	28.40	36,644	0.04	836.00	24.54	13.10	80.91
YAKIMA BASIN	32	33,379	5.13	41.79	1.57	0.93	38.27	26.47	51,451	0.05	1,104.84	45.89	11.00	78.71
SPOKANE BASIN	27	21,376	9.34	20.83	0.84	0.72	17.81	21.61	25,026	0.02	663.48	16.19	14.91	66.40
GROUP "E"	21	25,591	5.76	N/A	0.61	N/A	37.80	28.42	29,631	0.02	526.59	22.41	9.85	67.47

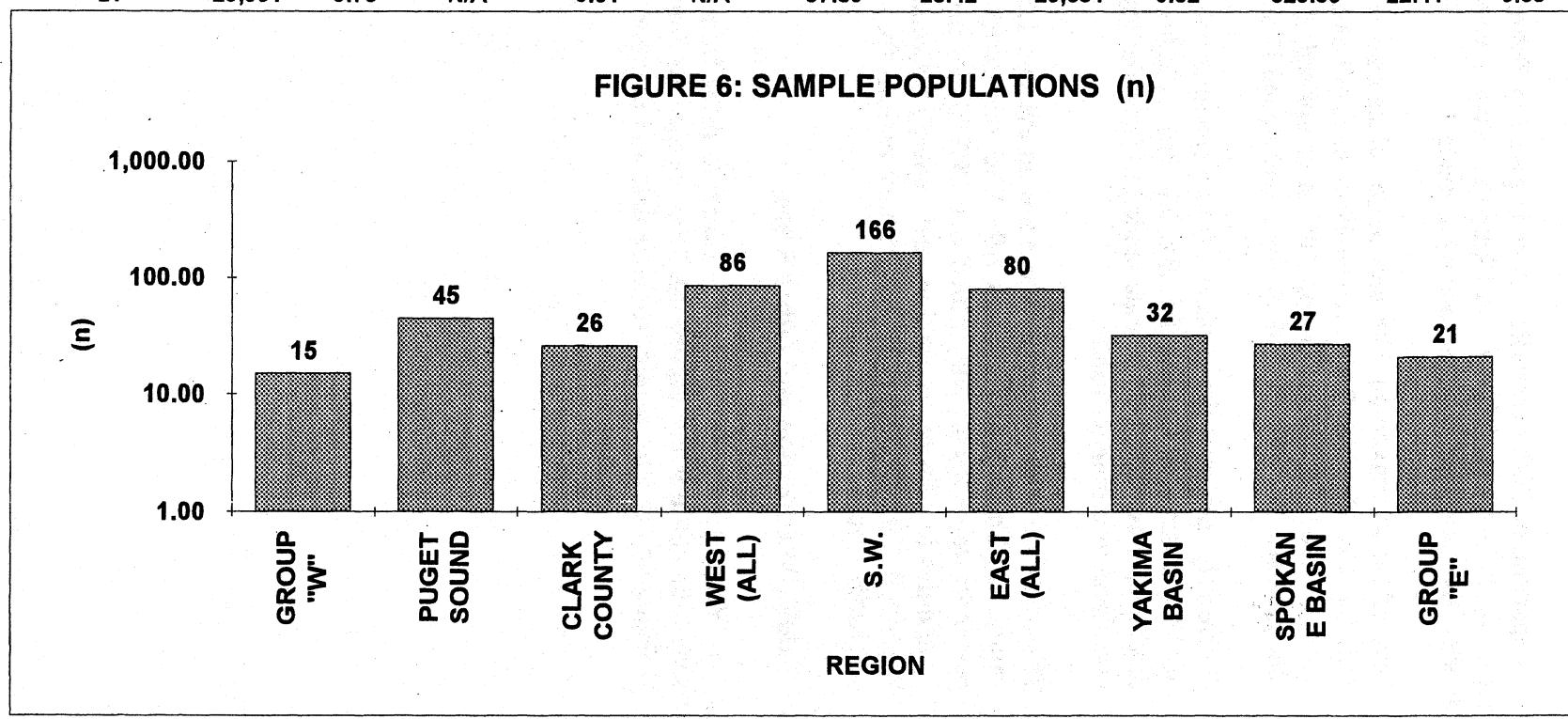
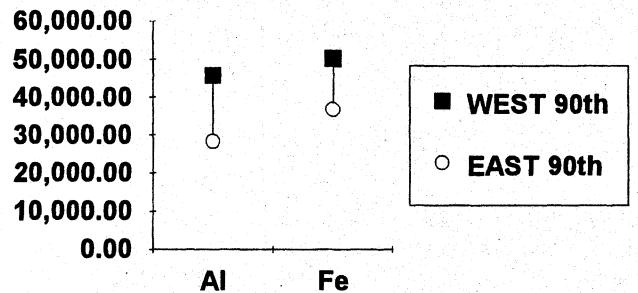
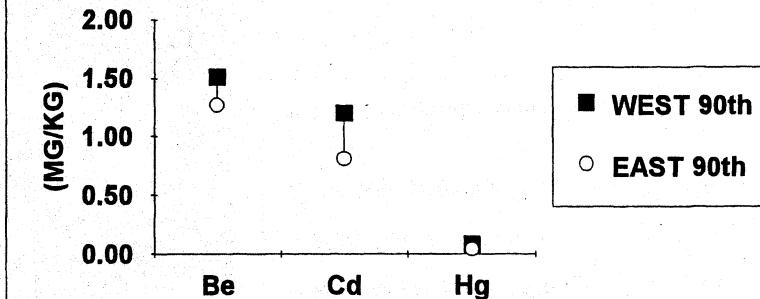
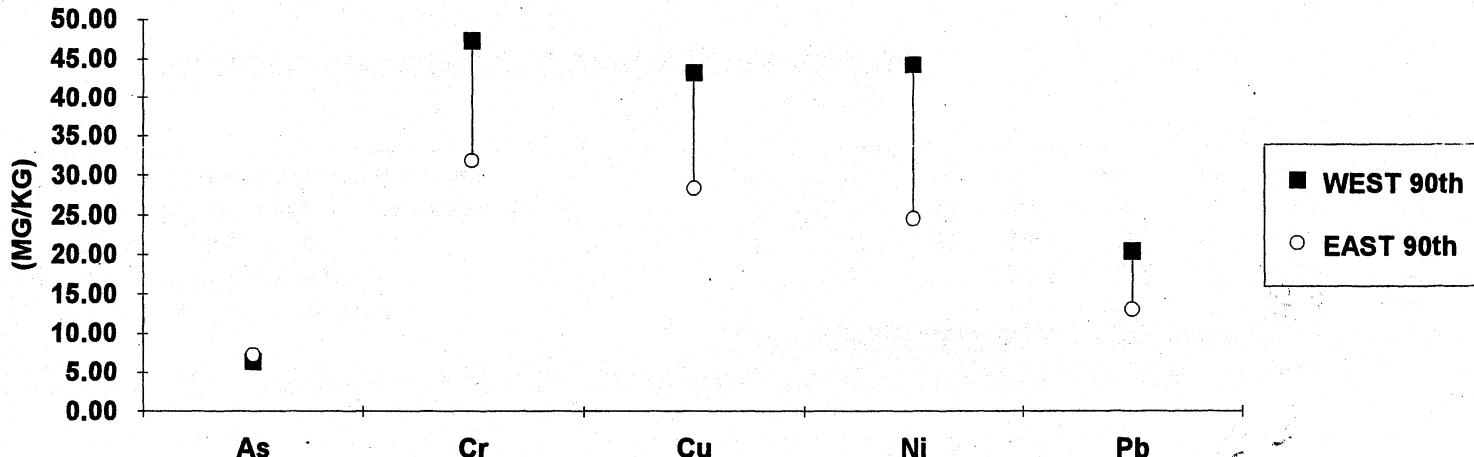
FIGURE 6: SAMPLE POPULATIONS (n)

TABLE 8: COMPARISON OF WEST/EAST 90th PERCENTILE VALUES

	Al	As	Be	Cd	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Zn
WEST (ALL)	45,735.00	6.37	1.51	1.20	47.40	43.23	50,125.00	0.08	1,337.27	44.20	20.42	98.39
EAST (ALL)	28,299.00	7.31	1.27	0.81	31.88	28.40	36,644.00	0.04	836.00	24.54	13.10	80.91
RATIO W:E	1.62		1.19	1.48	1.49	1.52	1.37	2.00	1.60	1.80	1.56	1.22
MEAN RATIO	1.53											

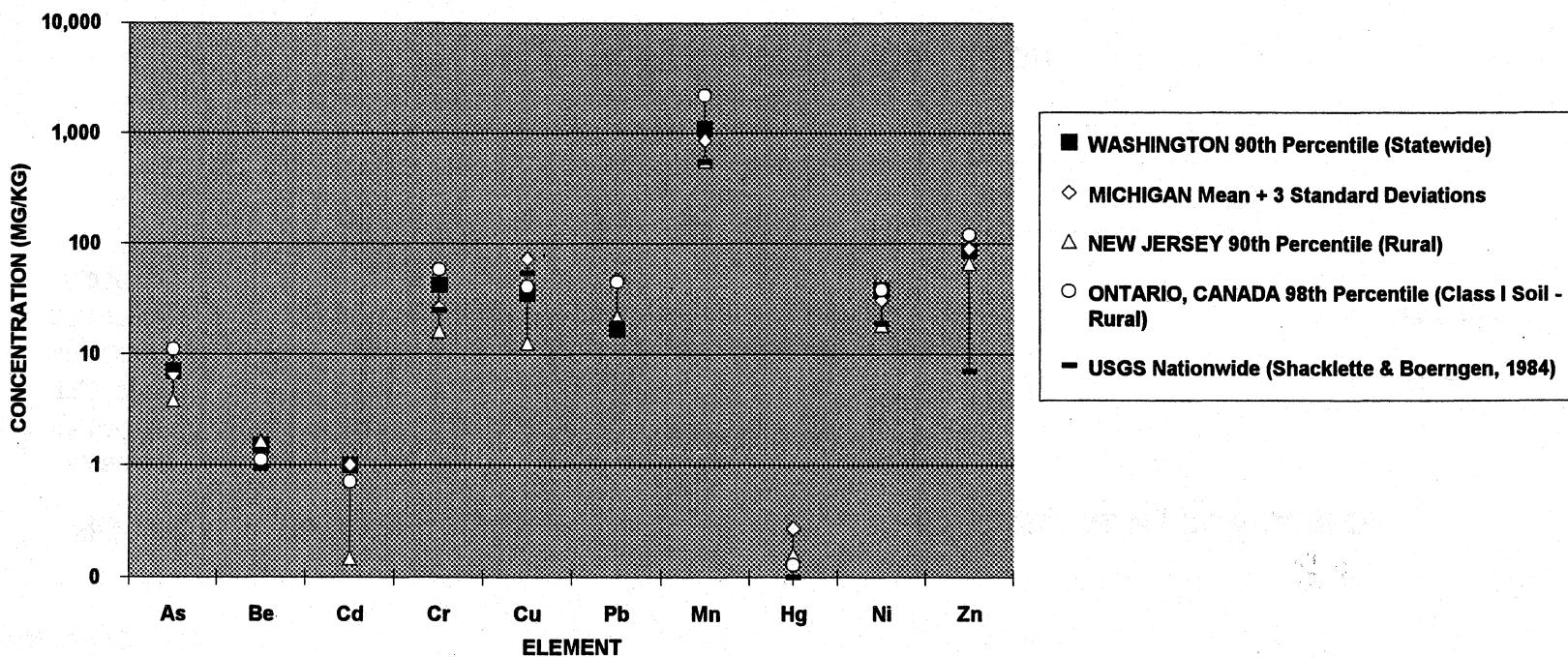
FIGURE 7: Al, Fe COMPARISON**FIGURE 8: Be, Cd, Hg COMPARISON****FIGURE 9: As, Cr, Cu, Ni, Pb COMPARISON**

*NA = VALUE NOT AVAILABLE

TABLE 9: COMPARISON OF WASHINGTON BACKGROUND VALUES TO OTHER STATES (MG/KG)

	As	Ba	Cd	Cr	Cu	Pb	Mn	Hg	Ni	Zn
WASHINGTON 90th Percentile (Statewide)	7	1.5	1	41.8	36	17	1095	0.07	38.2	85.8
MICHIGAN Mean + 3 Standard Deviations	7	*NA	1	26.2	72.2	47	855.8	0.27	30.9	90.3
NEW JERSEY 90th Percentile (Rural)	4	1.63	0.15	16.5	12.8	22	561	0.16	18.7	65.9
ONTARIO, CANADA 98th Percentile (Class I Soil - Rural)	11	1.1	0.71	58	41	45	2,200	0.13	38	120
USGS Nationwide (Shacklette & Boerngen, 1984)	7	0.92	*NA	25	54	19	550	0.1	19	7

FIGURE 10: BACKGROUND VALUE COMPARISON



VII. ANALYSIS OF REGIONAL VARIATION

Overview

Due to time, budget, and resources, a highly sophisticated statistical analysis of the variation in data between regions was not performed. Routine comparative methods were instead employed to analyze the data. Due to the significant variation in climate, soils, geology, vegetation, population, etc. throughout Washington, the decision was made to simply compare the following values from each data set: (a) 90th percentile; (b) maximum and minimum; and (c) median (see Figures 11-22). A brief discussion on the observations made per element is also included in this section.

Data Sets

For comparison purposes, the data were subdivided into nine basic groups (see Table 10 below). Sampling data from Puget Sound, Yakima Basin, Clark County, and Spokane Basin comprise four groups. Three additional groups were created by pooling data into west, east, and statewide groups. The Cascade Mountain Range was used as a dividing line for the west/east data groups. Group "W" contains that data independent of the Puget Sound and Clark County data sets. Group "E" contains that data independent of the Yakima and Spokane Basins data sets.

Table 10: Data Subdivisions

Data Group	Sample Population	Definition
Group "W"	15	Whatcom and Skagit Counties, Pacific Coast (Grays Harbor, Lewis, and Pacific Counties).
Puget Sound	45	Snohomish, King, Pierce, Thurston, Mason, Jefferson, Island, San Juan, and Clallam Counties.
Clark County	26	Clark County
West (All)	86	All sampling locations west of the Cascade Mountain Range
Statewide	166	All statewide sampling locations
East (All)	80	All sampling locations east of the Cascade Mountain Range
Yakima Basin	32	Yakima, Kittitas, Chelan, and Grant Counties
Spokane Basin	27	Spokane, Lincoln, and Pend Oreille Counties
Group "E"	21	Benton, Spokane, Lincoln, Adams, Okanogan, and Whitman Counties

Aluminum

A notable west-east trend was observed in the aluminum data set (see **Figure 24**). Both the 90th percentile and lognormal mean values for west-side are nearly twice as high as the east side data (see **Table 11** below). The reason for this is unknown; however, it is suspected that the wet west-side climate is probably a significant factor (i.e., the formation of bauxite). Higher aluminum concentrations (greater than 40,000 mg/kg) were detected in Whatcom County (Mt. Baker), along the Pacific Coast (Pacific County) and the Clark County Vancouver area. Significantly lower aluminum values (less than 20,000 mg/kg) were detected in the Spokane Basin (see **Figure 11**).

Table 11: Aluminum 90th Percentile and Lognormal Mean Values - West and East Data

Value	West (n = 86)	East (n = 80)
90th Percentile	45,700	28,300
Lognormal Mean	25,500	18,200

All Values = mg/kg n = sample population

Arsenic

The statewide distribution of arsenic in soil was remarkably uniform throughout the state (between 1 - 10 mg/kg, see **Figures 12 and 26**). Specifically, there was very little variation in the median and 90th percentile values for each data set (see **Figure 9**). One possible reason for nominal variation in the arsenic data set is the used of atomic absorption analytical methods, which is considered to be more reliable for arsenic at lower concentrations (as opposed to ICP methods). Arsenic was the only element whose 90th percentile value was higher in Eastern Washington. Higher arsenic values (greater than 50 mg/kg) were detected in the Tacoma vicinity (Pt. Defiance Park)--probably due to fallout from the Asarco Smelter. Higher values were also detected in the Yakima Basin, which may be due to the extensive use of arsenic-based pesticides.

Beryllium

The variation in the statewide distribution of beryllium was somewhat unusual. Specifically, higher values (greater than 1 mg/kg) were observed only in the Vancouver area and Central Washington (Yakima and Ellensburg). The Clark County beryllium data are also unique in that the data are normally distributed and the 90th percentile value, 2.1 mg/kg, was notably higher than all other data sets (see **Figure 13**).

Cadmium

The statewide distribution of cadmium was relatively uniform, with approximately 40% (61 out of 165 values) of the data set at or below detection limits (less than 0.2 or 0.8 mg/kg, see **Figures 14 and 30**).

Chromium

A significant west-east variation was noted in the chromium data set. An examination of the statewide chromium concentration map (see Figure 32) finds that the west-side values are notably higher than the east. Higher chromium values were detected in the Mt. Baker area (Region "D;" Northern Skagit and Whatcom Counties). The reason for the detection of higher chromium values in this area is not known. However, the difference between west to east 90th percentile values (47.4 vs. 31.9 mg/kg) is not considered to be important from a cleanup perspective since the MTCA Method A soil cleanup level for chromium, 100 mg/kg, is over twice the statewide or area background values.

Copper

A slight west-east trend was observed in the copper data set. Specifically, there is a noticeable lack of higher values (greater than 40 mg/kg) in the Spokane Basin region. However, there is a fairly constant distribution (10-100 mg/kg) in copper from Yakima to Seattle (see Figure 33).

Iron

Very little variation was observed in the iron data set. Examination of the X,Y scatter plot (see Figure 35) reveals a straight-line set of values between 1,000 and 100,000 mg/kg. However, there was some variation in the iron data for Clark County, as noted by the detection of the maximum 90th percentile value (58,700 mg/kg) in this region.

Lead

The lead data set is unique in that it appears to mimic statewide population trends; i.e., higher values were detected in more densely populated regions (Seattle, Vancouver, Yakima, and Spokane, see Figure 38). Higher lead values in more densely populated areas may be due to fallout from automobile exhaust. However, an examination of the X,Y scatter plot finds that nearly all the lead values tended to fall between 2 and 20 mg/kg (see Figure 37).

Manganese

The variation in the manganese data set was relatively nominal with nearly all values falling between 100 and 1,000 mg/kg. The one exception was the Clark County data set, which was normally distributed with a median value of 510 mg/kg (max value observed, see Figure 19). Higher manganese concentrations (greater than 1,000 mg/kg) were observed in the Vancouver, Yakima, and the Seattle-Tacoma-Olympia corridor.

Nickel

A noticeable west-east trend was observed in the nickel data set. Values greater than 20 mg/kg were not detected east of Yakima (see Figure 44).

Zinc

Very little variation was observed in the statewide zinc data set. Nearly all the values fell between 10 and 100 mg/kg (see Figures 45 & 46).

Other Elements

Background data were also compiled for ten other elements: antimony (Sb), barium (Ba), calcium (Ca), cobalt (Co), magnesium (Mg), sodium (Na), selenium (Se), titanium (Ti), thallium (Tl), and vanadium (V). The Ba, Ca, Co, Mg, Na, Ti, and V data were collected only in the Spokane Basin area, and the data for Ag, Sb, Se is limited since these elements were normally not detected above laboratory detection limits. Because of these two factors, an assessment of the regional variation for these elements was not completed. A brief summary of the 90th percentile values for these elements is given in Figure 47.

Antimony

Approximately 10% of the data set (50 samples) exceed laboratory detection limits (ICP analysis @ 3 mg/kg). Based on this data, a 90th percentile value of 5 mg/kg was calculated for Sb.

Selenium

The ICP data for selenium were not assessed because the standard detection limits used were too high (5 - 15 mg/kg). Only 14 selenium samples exceeded atomic absorption (AA) analytical detection limits. Of these 14, only two were given a laboratory code of "J," which means that the analyte was positively identified. The remaining 12 were assigned a laboratory code of "P," which means that the analyte was detected above the instrument detection limit but below the established minimum quantitation limit. Based on those samples exceeding AA detection limits, a 90th percentile value of 0.78 mg/kg was estimated for selenium.

Silver

Less than 10% of the data set (33 samples) exceeded laboratory detection limits (0.3 mg/kg). Based on this data, a 90th percentile value of 0.61 mg/kg was calculated.

Thallium

Values above the laboratory detection limit (5 mg/kg) were not detected.

Why are the West-Side Background Values Higher?

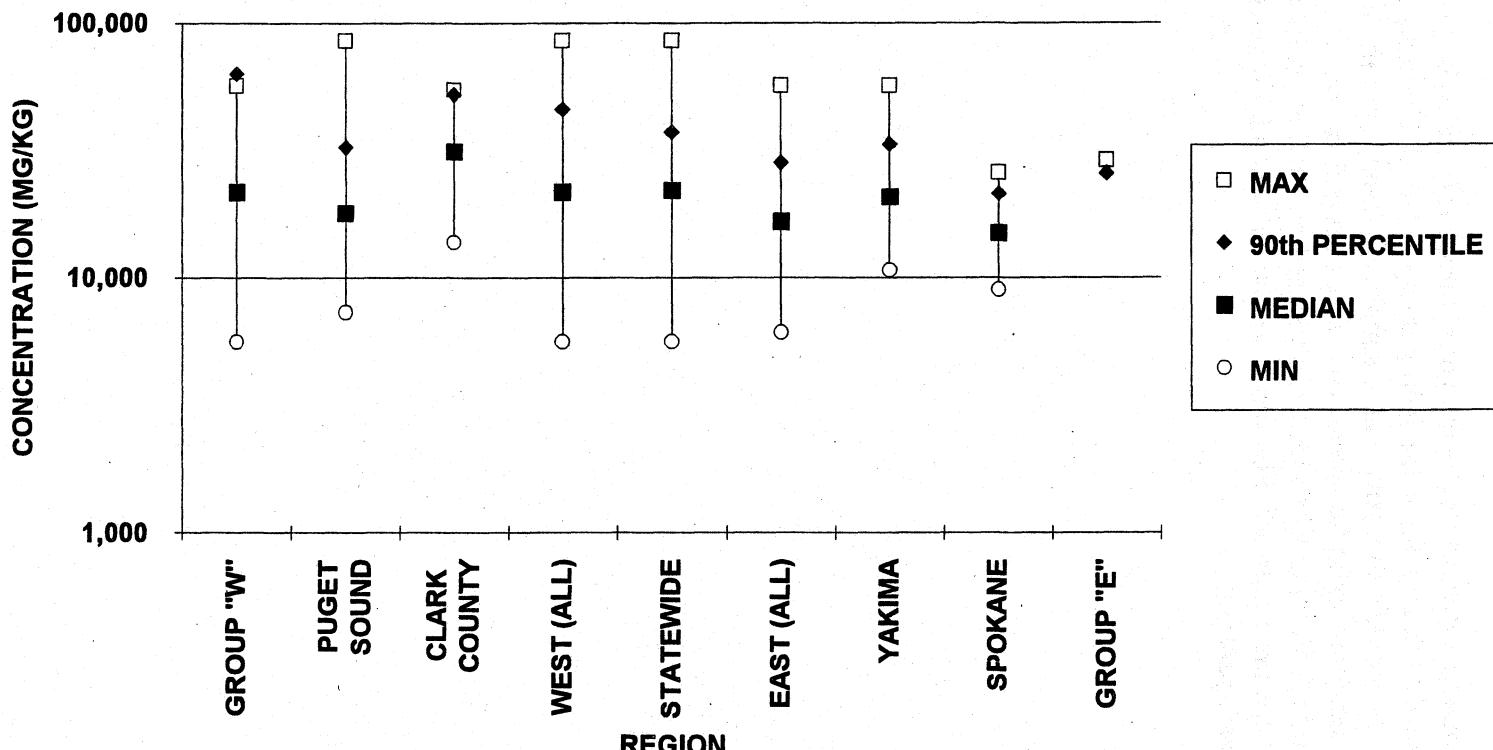
The formation of soils is to a large degree a weathering phenomenon that is heavily influenced by climate and vegetation. Thus, the wet climate and dense vegetation of Western Washington has undoubtedly been a significant factor in the formation of west-side soils. Conversely, the much

dryer climate and sparser vegetative pattern in Eastern Washington has likely produced a different type of soil.

Geologic Diversity

The actual effect of Washington's diverse geologic makeup upon this study is thought to be somewhat nominal. Specifically, nearly all of the data points for the 12 elements fall within one order of magnitude. Thus, if geologic diversity was a significant issue, then the argument could conceivably be made that the data should be spread out across several orders of magnitude. However, it should also be kept in mind that this study focused on surficial soils only. Thus, it may not be appropriate to compare the results of this study against the potential impact of geologic diversity upon the entire soil spectrum.

FIGURE 11: ALUMINUM REGIONAL ANALYSIS

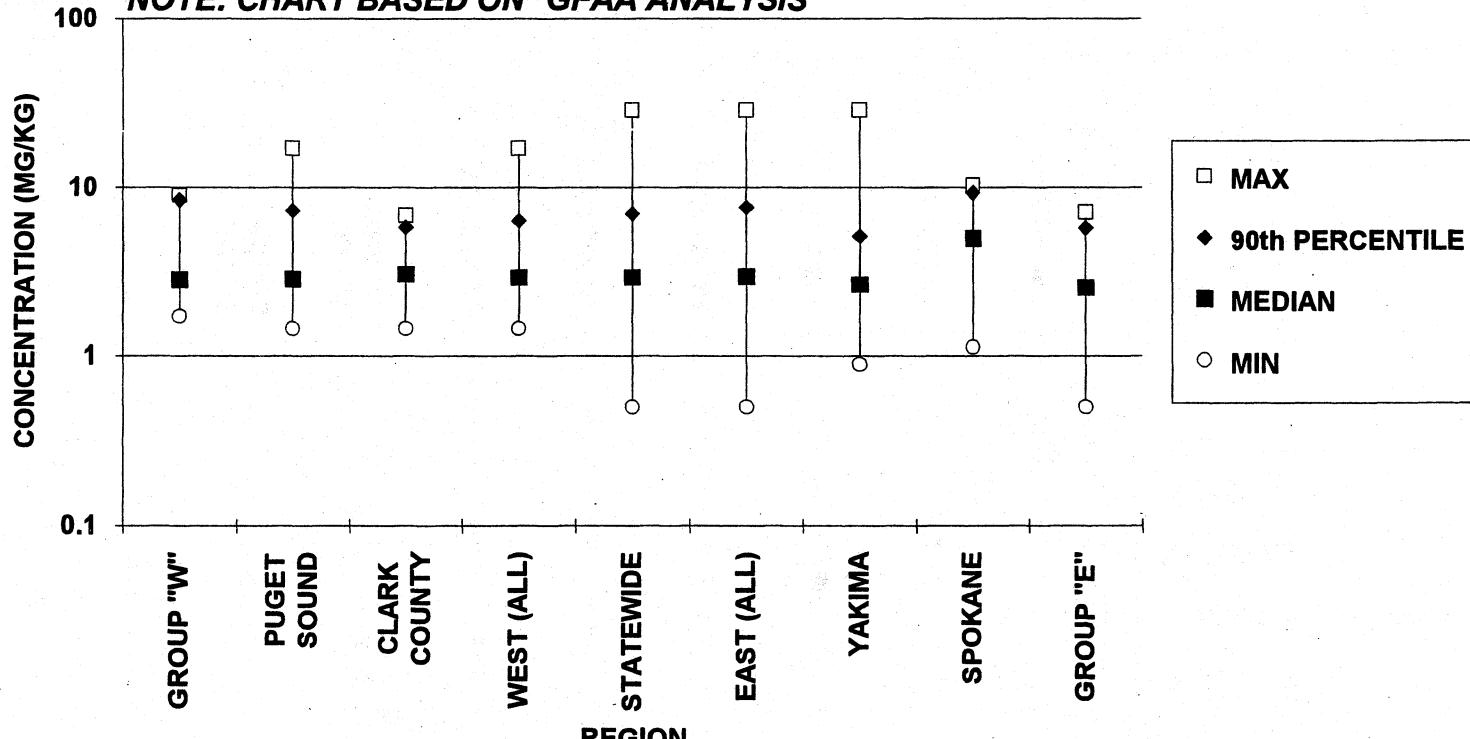


ALL VALUES = MG/KG	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA	SPOKANE	GROUP "E"
MAX	56,550	84,900	54,550	84,900	84,900	56,550	56,550	25,850	29,000
90th PERCENTILE	52,905	42,581	52,276	45,735	37,296	28,299	33,379	21,376	25,591
MEDIAN	21,700	17,900	31,192	21,760	21,956	16,600	20,800	15,000	14,800
MIN	5,670	7,390	13,750	5,670	5,670	6,140	10,650	8,933	6,140

NOTE: GROUP "W" = WHATCOM, SKAGIT, GRAYS HARBOR, LEWIS, AND PACIFIC COUNTIES
 GROUP "E" = BENTON, SPOKANE, LINCOLN, ADAMS, OKANOGAN, AND WHITMAN COUNTIES

FIGURE 12: ARSENIC REGIONAL ANALYSIS

NOTE: CHART BASED ON *GFAA ANALYSIS



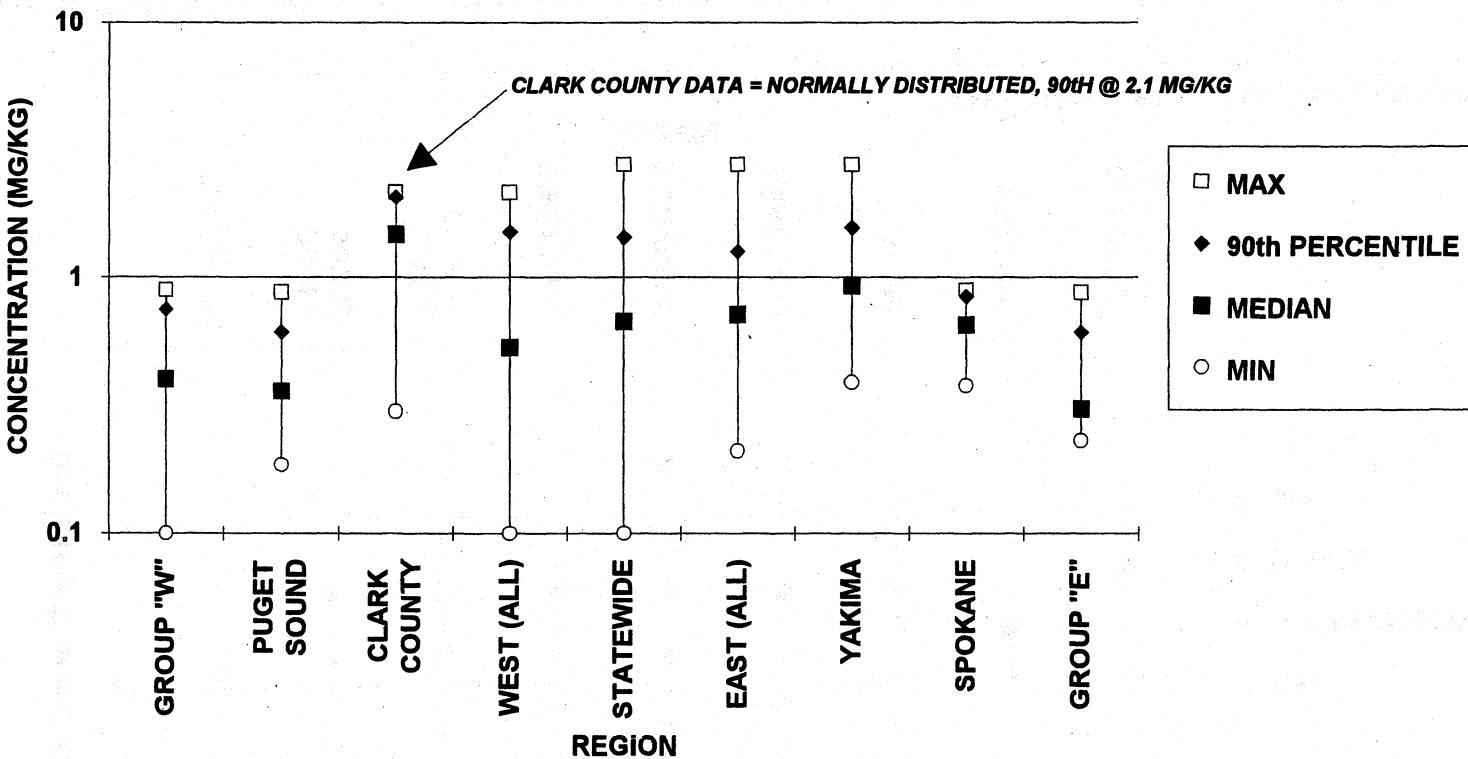
*GFAA = GRAPHITE FURNACE ATOMIC ABSORPTION

ALL VALUES	MG/KG	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA	SPOKANE	GROUP "E"
MAX	8.99	17.17	6.89	17.168	28.6	28.6	28.6	10.32	7.19	
90th PERCENTILE	8.47	7.30	5.81	6.37	6.39	7.61	5.13	9.34	5.76	
MEDIAN	2.8	2.86	3.045	2.91	2.92	2.95	2.64	4.99	2.53	
MIN	1.7	1.45	1.45	1.45	0.5	0.5	0.89	1.13	0.5	

NOTE: GROUP "W" = WHATCOM, SKAGIT, GRAYS HARBOR, LEWIS, AND PACIFIC COUNTIES

GROUP "E" = BENTON, SPOKANE, LINCOLN, ADAMS, OKANOGAN, AND WHITMAN COUNTIES

FIGURE 13: BERYLLIUM REGIONAL ANALYSIS

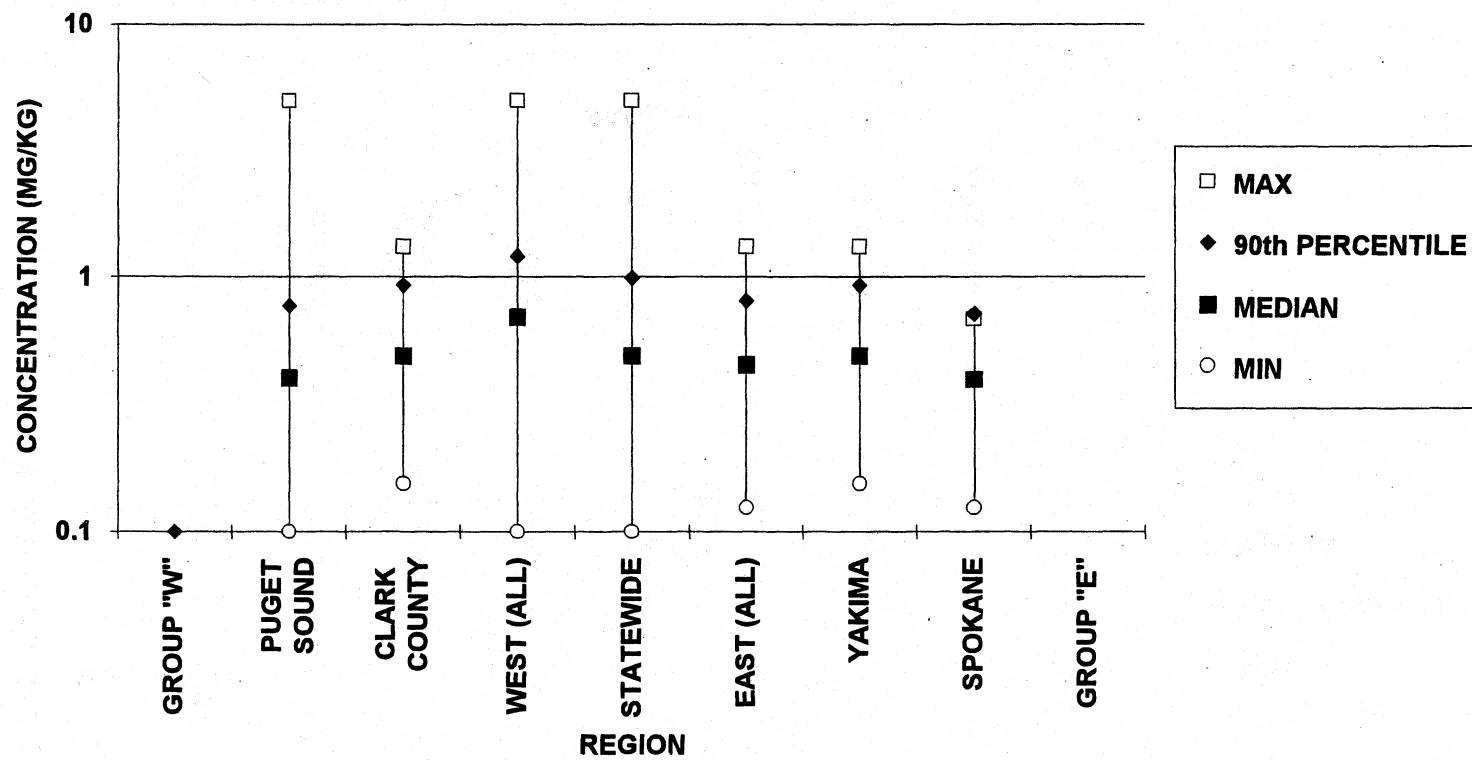


ALL VALUES - MG/KG	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA	SPOKANE	GROUP "E"
MAX	0.89	0.875	2.155	2.155	2.79	2.79	2.79	0.89	0.875
90th PERCENTILE	0.75	0.61	2.07	1.51	1.44	1.27	1.57	0.61	0.51
MEDIAN	0.4	0.358	1.479	0.53	0.67	0.72	0.93	0.655	0.305
MIN	0.1	0.185	0.3	0.1	0.1	0.21	0.39	0.37775	0.23

NOTE: GROUP "W" = WHATCOM, SKAGIT, GRAYS HARBOR, LEWIS, AND PACIFIC COUNTIES

GROUP "E" = DENTON, SPOKANE, LINCOLN, ADAMS, OKANOGAN, AND WHITMAN COUNTIES

FIGURE 14: CADMIUM REGIONAL ANALYSIS

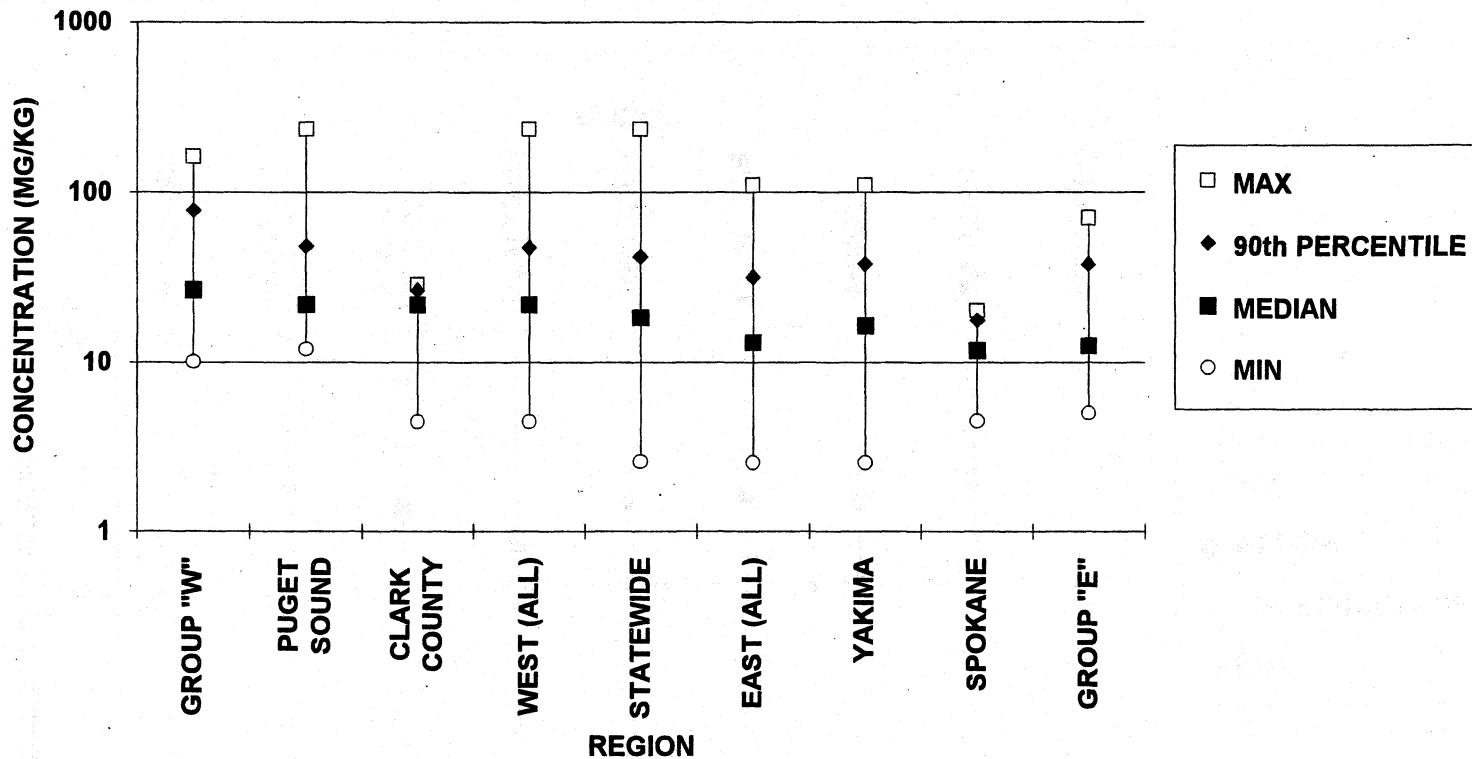


ALL VALUES = MG/KG	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA	SPOKANE	GROUP "E"
MAX	N/A	5	1.32	5	5	1.32	1.32	0.685	N/A
90th PERCENTILE	0.1	0.77	0.49	1.2	0.99	0.51	0.72	0.72	N/A
MEDIAN	N/A	0.4	0.49	0.7	0.49	0.45	0.49	0.395	N/A
MIN	N/A	0.1	0.155	0.1	0.1	0.125	0.155	0.125	N/A

NOTE: GROUP "W" = WHATCOM, SKAGIT, GRAYS HARBOR, LEWIS, AND PACIFIC COUNTIES

GROUP "E" = DENTON, SPOKANE, LINCOLN, ADAMS, OKANOGAN, AND WHITMAN COUNTIES

FIGURE 15: CHROMIUM REGIONAL ANALYSIS

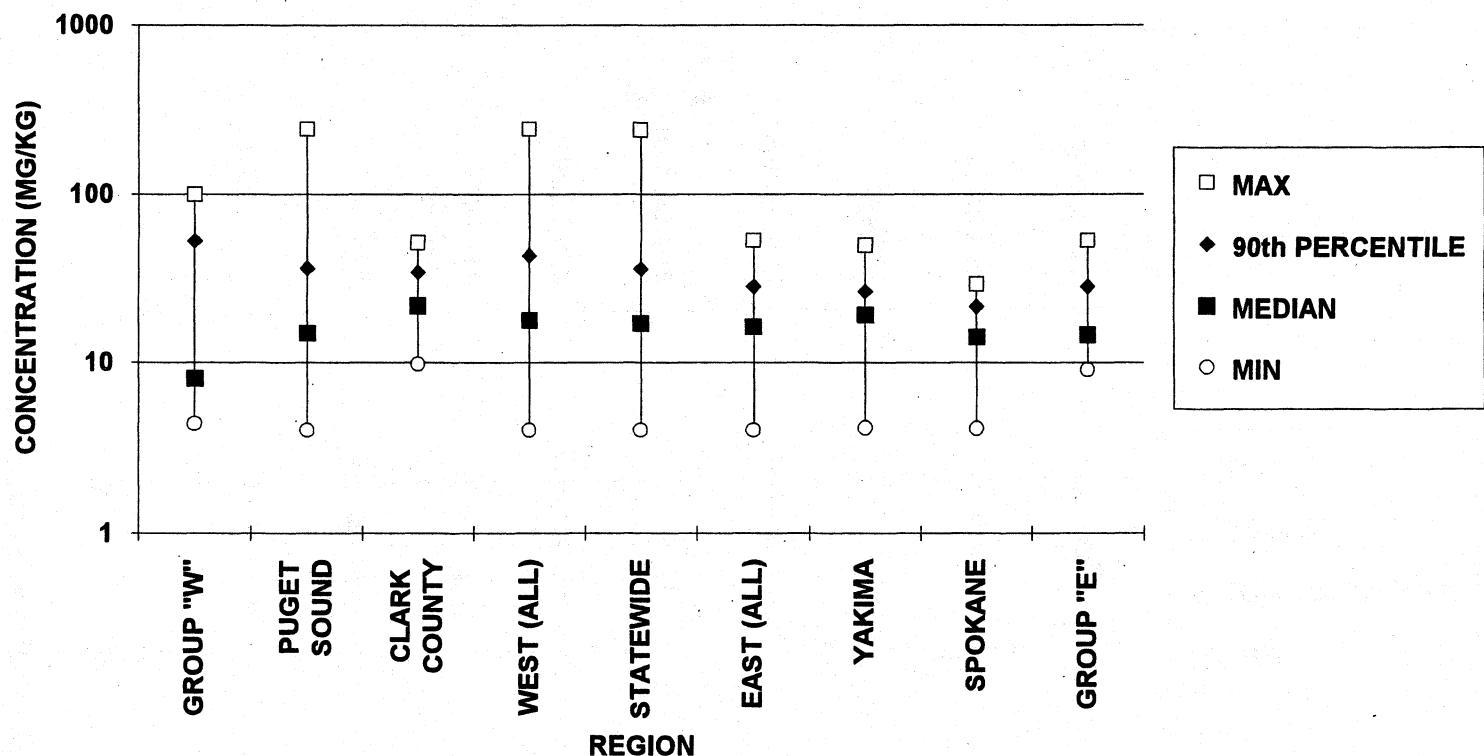


ALL VALUES = MG/KG	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA	SPOKANE	GROUP "E"
MAX	163	235	28.83	235	235	110.3	110.3	20.25	71.3
90th PERCENTILE	78.46	48.45	28.57	47.4	49.88	31.89	38.27	17.81	37.8
MEDIAN	26.7	22	21.99	22	18.42	13.15	16.42	11.78	12.6
MIN	10.1	12	4.42	4.42	2.56	2.55	2.55	4.5	5

NOTE: GROUP "W" = WHATCOM, SKAGIT, GRAYS HARBOR, LEWIS, AND PACIFIC COUNTIES

GROUP "E" = BENTON, SPOKANE, LINCOLN, ADAMS, OKANOGAN, AND WHITMAN COUNTIES

FIGURE 16: COPPER REGIONAL ANALYSIS

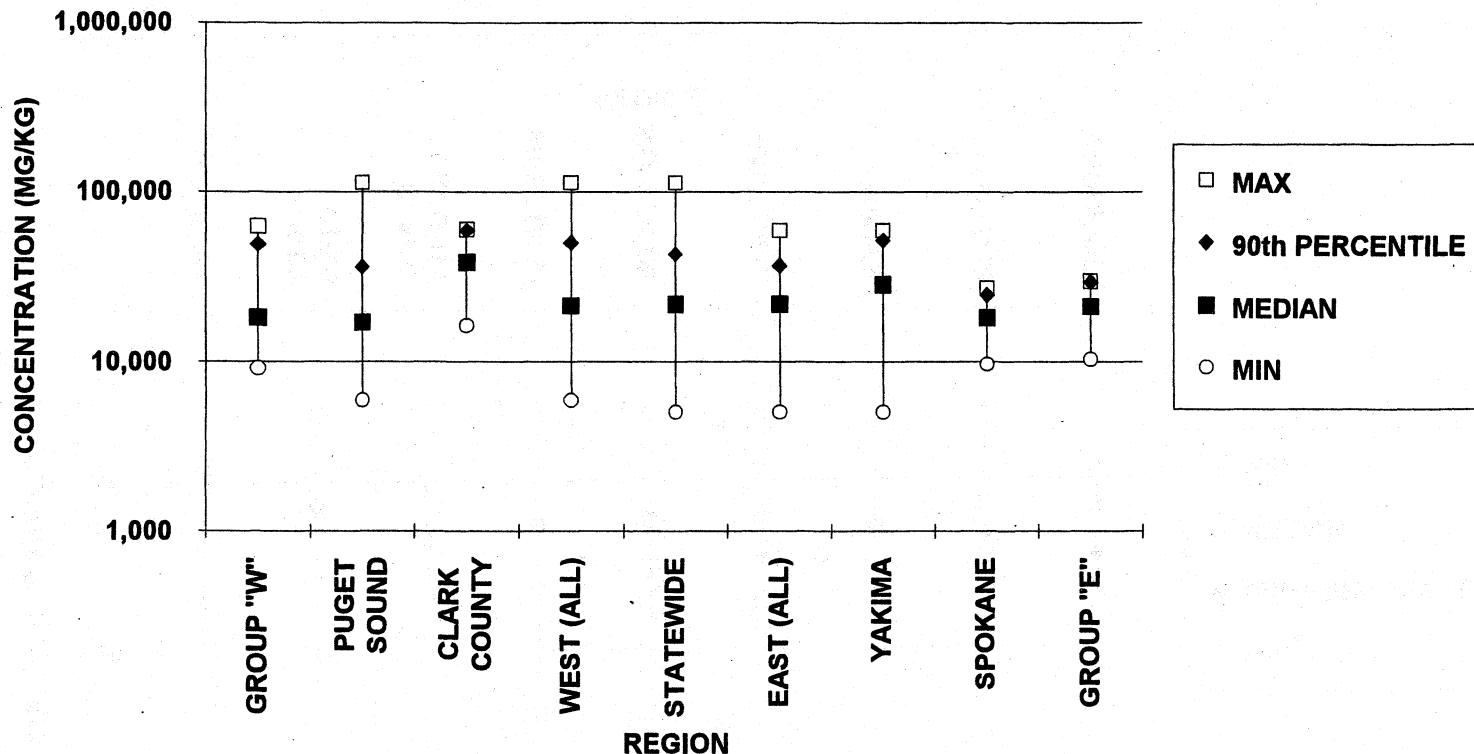


ALL VALUES = MG/KG	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA	SPOKANE	GROUP "E"
MAX	99.4	243.5	51.71	243.5	243	53	50.15	29.03	53
90th PERCENTILE	52.85	36.36	34.43	43.43	36.01	28.4	26.47	21.61	26.42
MEDIAN	8.05	15	21.78	17.8	17.07	16.3	19.225	14.14	14.7
MIN	4.33	4	9.71	4	4	4	4.125	4.04	9.1

NOTE: GROUP "W" = WHATCOM, SKAGIT, GRAYS HARBOR, LEWIS, AND PACIFIC COUNTIES

GROUP "E" = BENTON, SPOKANE, LINCOLN, ADAMS, OKANOGAN, AND WHITMAN COUNTIES

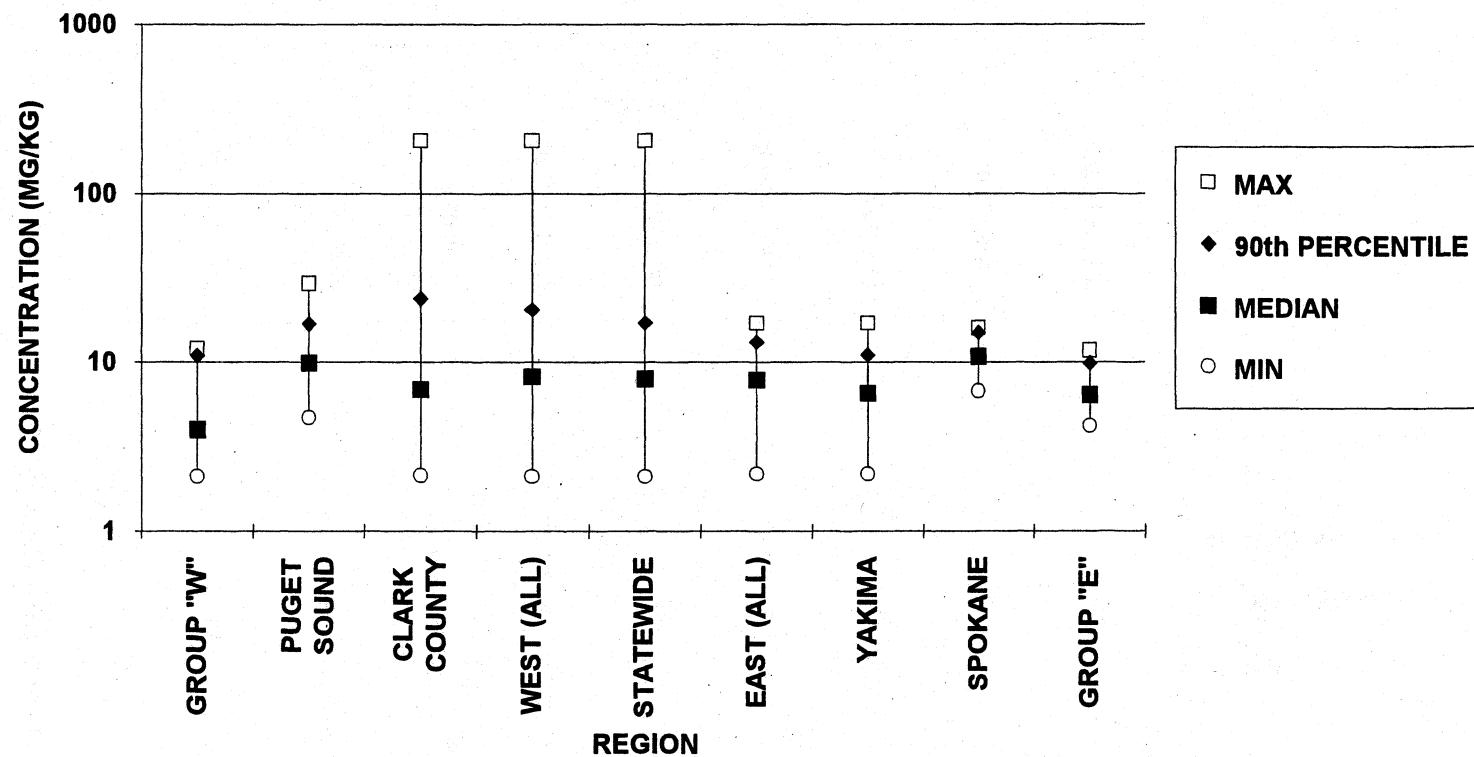
FIGURE 17: IRON REGIONAL ANALYSIS



ALL VALUES - MG/KG	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA	SPOKANE	GROUP "E"
MAX	62,800	112,500	59,850	112,500	112,500	58,800	58,880	27,000	30,000
90th PERCENTILE	49,170	36,126	59,850	50,725	43,106	36,544	51,451	25,026	29,631
MEDIAN	18,200	17,050	38,508	21,433	22,033	22,116	28,821	18,150	21,300
MIN	9,160	5,920	16,350	5,920	5,025	5,025	5,025	9,670	10,400

NOTE: GROUP "W" = WHATCOM, SKAGIT, GRAYS HARBOR, LEWIS, AND PACIFIC COUNTIES
 GROUP "E" = BENTON, SPOKANE, LINCOLN, ADAMS, OKANOGAN, AND WHITMAN COUNTIES

FIGURE 18: LEAD REGIONAL ANALYSIS

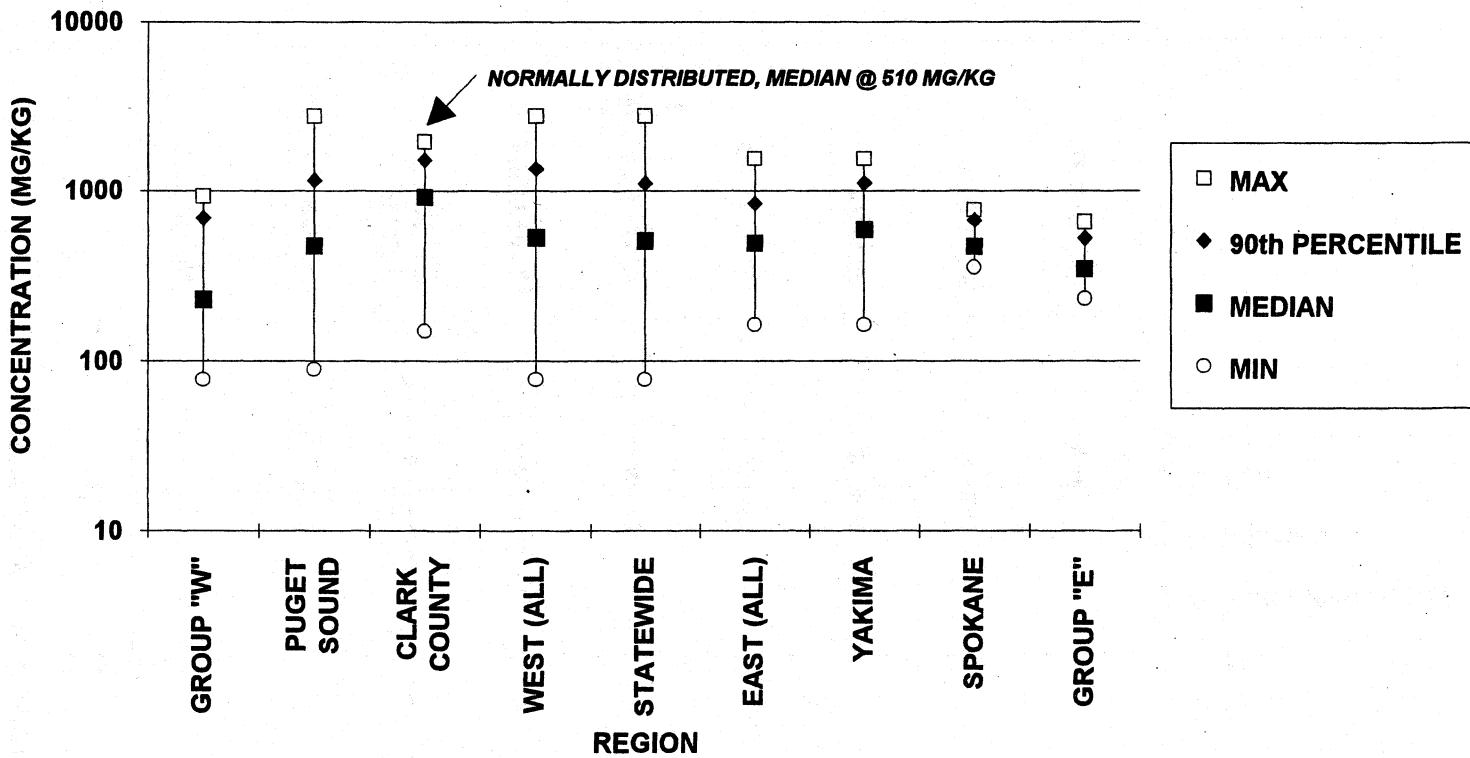


ALL VALUES = MG/KG	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA	SPOKANE	GROUP "E"
MAX	12	29.6	207.5	207.5	207.5	17.1	17.1	16	11.7
90th PERCENTILE	16.53	24.61	20.42	17.09	13.1	11	14.91	9.85	
MEDIAN	4	9.8	6.86	8.2	7.9	7.82	6.525	10.8	6.4
MIN	2.1	4.65	2.125	2.1	2.1	2.17	2.17	6.75	4.2

NOTE: GROUP "W" = WHATCOM, SKAGIT, GRAYS HARBOR, LEWIS, AND PACIFIC COUNTIES

GROUP "E" = BENTON, SPOKANE, LINCOLN, ADAMS, OKANOGAN, AND WHITMAN COUNTIES

FIGURE 19: MANGANESE REGIONAL ANALYSIS

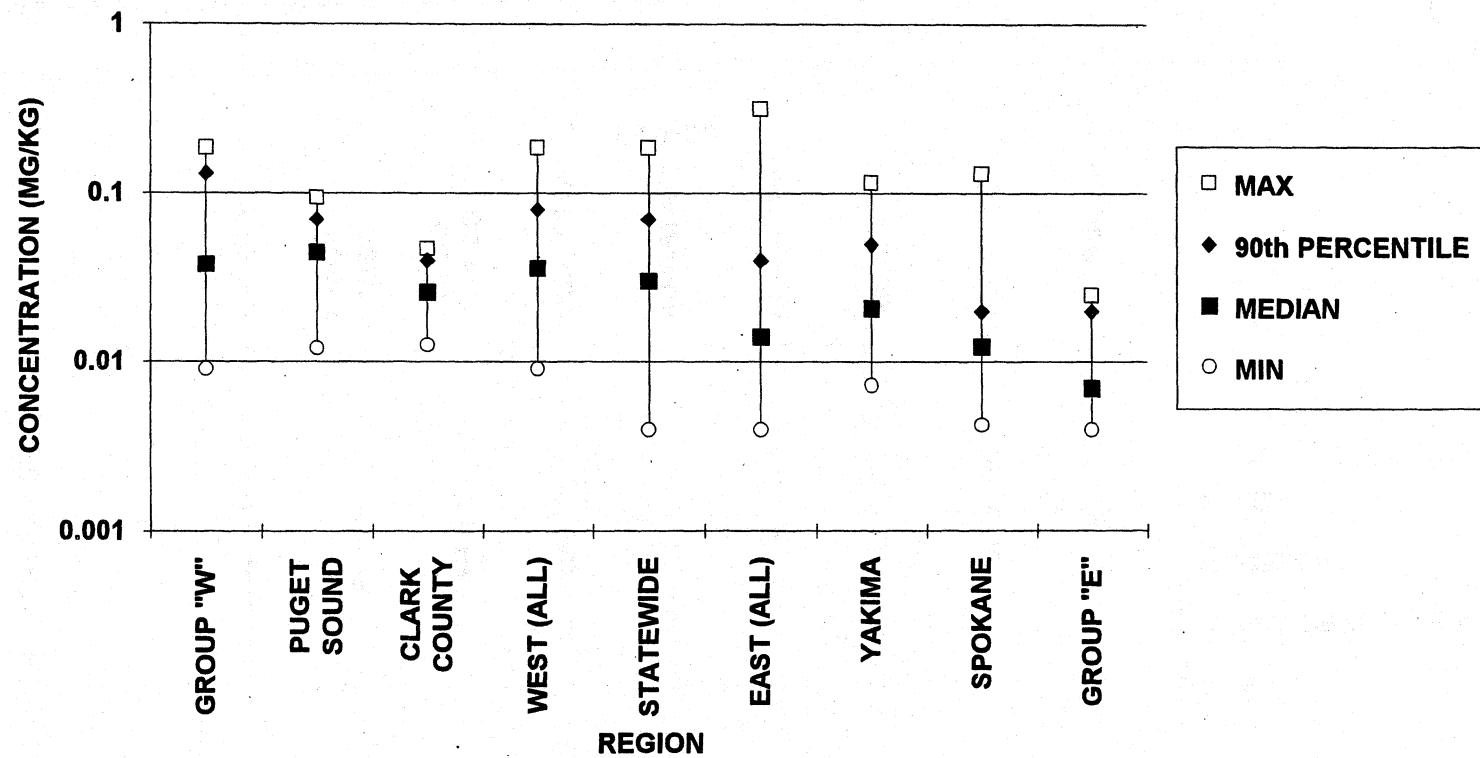


ALL VALUES = MG/KG	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA	SPOKANE	GROUP "E"
MAX	930	2750	1960	2750	2750	1546.12	1546	769.5	652
90th PERCENTILE	801.75	1146	1511	13727	1094.55	836	1164.54	653.43	526.53
MEDIAN	231	474	915.5	531.25	509.58	490.75	589	470	345
MIN	78	90	150	78	78	164.45	164.45	354.5	233

NOTE: GROUP "W" = WHATCOM, SKAGIT, GRAYS HARBOR, LEWIS, AND PACIFIC COUNTIES

GROUP "E" = BENTON, SPOKANE, LINCOLN, ADAMS, OKANOGAN, AND WHITMAN COUNTIES

FIGURE 20: MERCURY REGIONAL ANALYSIS

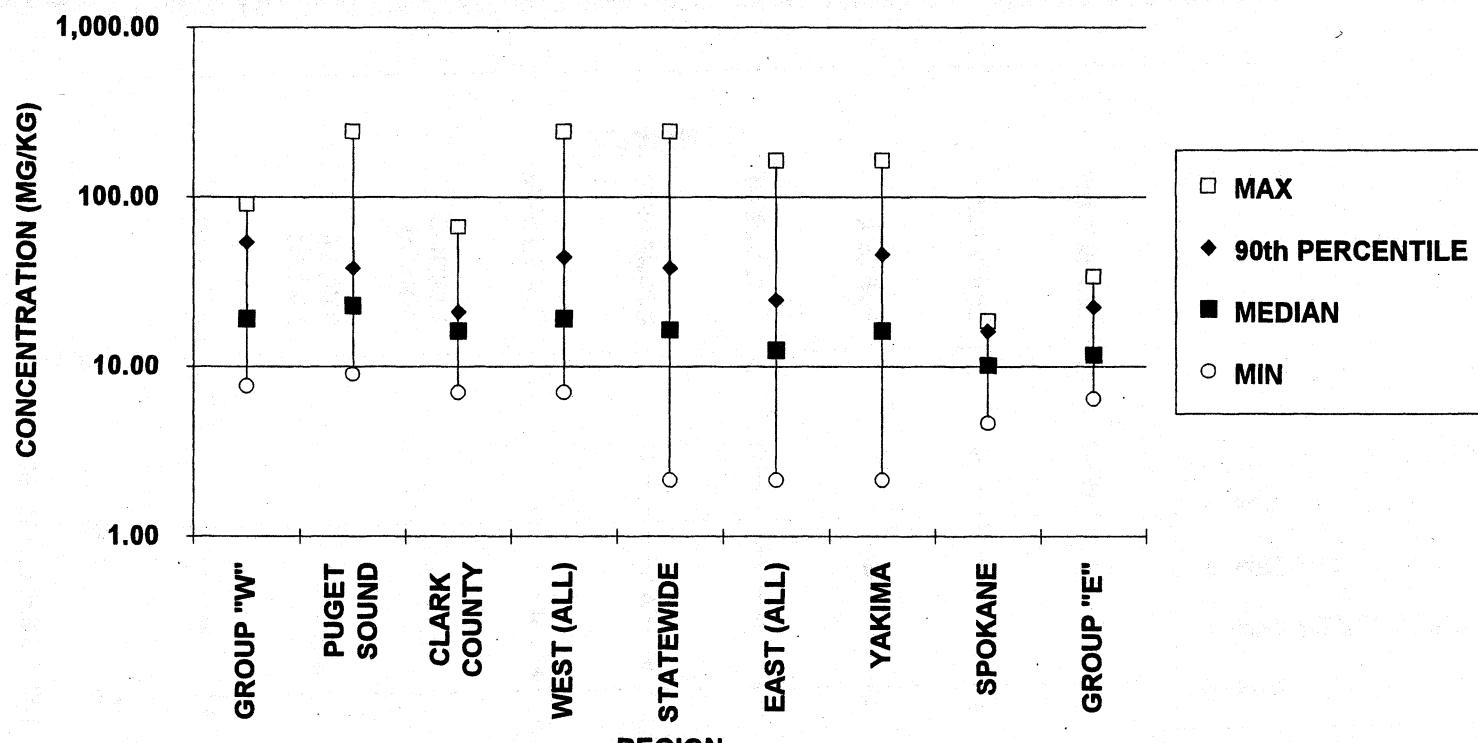


ALL VALUES = MG/KG	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA	SPOKANE	GROUP "E"
MAX	0.185	0.0944	0.047	0.185	0.185	0.312	0.1165	0.1312	0.025
90th PERCENTILE	0.12	0.07	0.04	0.08	0.07	0.04	0.05	0.03	0.02
MEDIAN	0.038	0.04475	0.026	0.0358	0.03	0.014	0.02075	0.01225	0.007
MIN	0.009	0.012	0.0125	0.009	0.004	0.004	0.00725	0.00425	0.004

NOTE: GROUP "W" = WHATCOM, SKAGIT, GRAYS HARBOR, LEWIS, AND PACIFIC COUNTIES

GROUP "E" = DENTON, SPOKANE, LINCOLN, ADAMS, OKANOGAN, AND WHITMAN COUNTIES

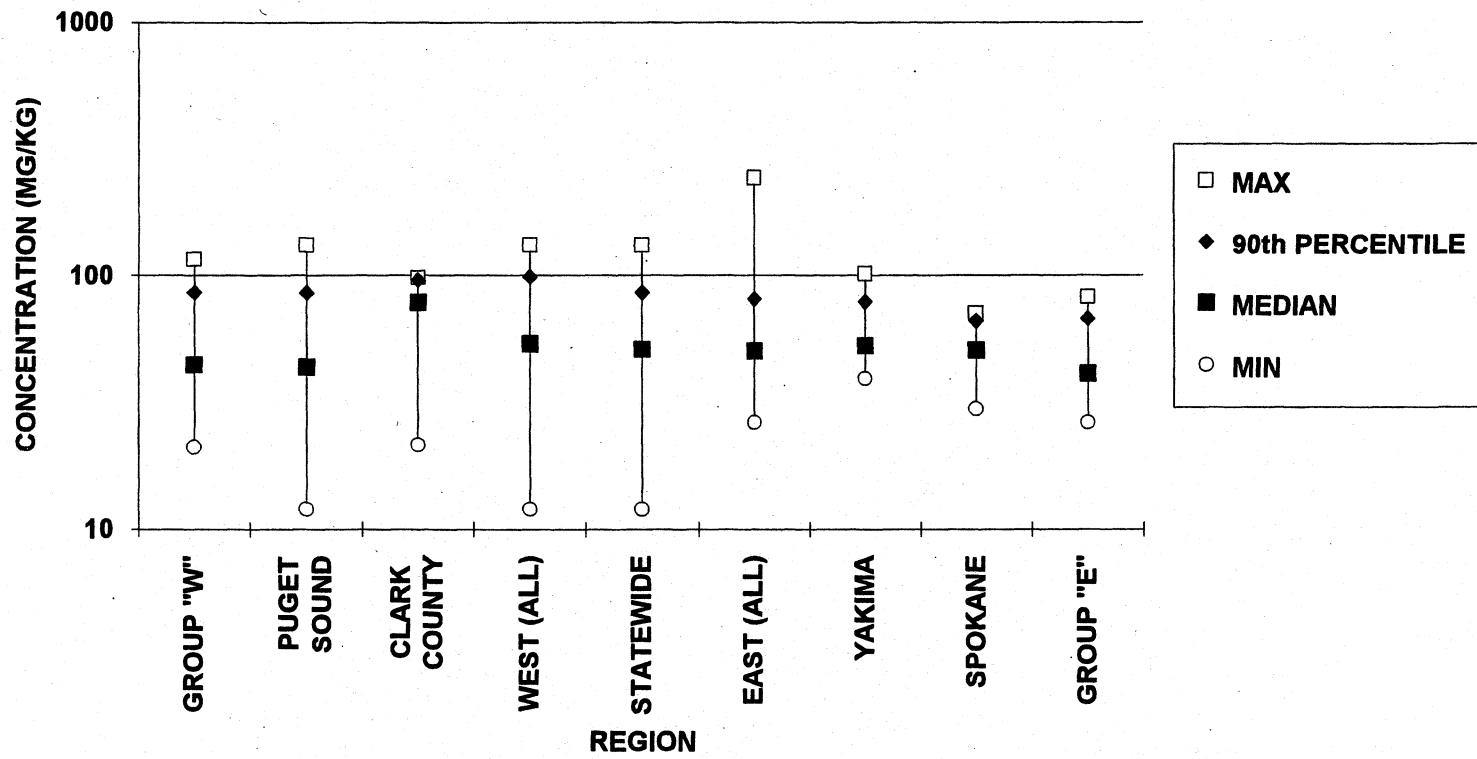
FIGURE 21: NICKEL REGIONAL ANALYSIS



All Values = mg/kg	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA	SPOKANE	GROUP "E"
MAX	91.10	244.50	66.75	244.50	244.50	163.00	163.00	18.60	34.10
90th PERCENTILE	54.19	38.19	21.04	44.20	38.19	24.54	45.89	16.19	22.41
MEDIAN	19.10	23.00	16.23	19.20	16.43	12.50	16.30	10.15	11.70
MIN	7.60	9.00	7.00	7.00	2.15	2.15	2.15	4.60	6.40

NOTE: GROUP "W" = WHATCOM, SKAGIT, GRAYS HARBOR, LEWIS, AND PACIFIC COUNTIES
 GROUP "E" = CENTON, SPOKANE, LINCOLN, ADAMS, CKANOGAN, AND WHITMAN COUNTIES

FIGURE 22: ZINC REGIONAL ANALYSIS



ALL VALUES - MG/KG	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA	SPOKANE	GROUP "E"
MAX	116	132.5	97.7	132.5	132.5	244.5	101.43	71	82.3
90th PERCENTILE	85.56	85.06	85.82	85.39	85.32	80.91	75.71	66.4	77.47
MEDIAN	44.5	43.65	78.5	54.075	51.12	50.64	52.9	50.9	41
MIN	21.1	12	21.4	12	12	26.3	39.3	29.7	26.3

NOTE: GROUP "W" = WHATCOM, SKAGIT, GRAYS HARBOR, LEWIS, AND PACIFIC COUNTIES

GROUP "E" = BENTON, SPOKANE, LINCOLN, ADAMS, OKANOGAN, AND WHITMAN COUNTIES

VIII. USE AND APPLICATION OF BACKGROUND VALUES

Site-Specific or Area Studies of Natural Background

The intent of this report is to provide detailed information on the natural background concentration of metals in soils throughout Washington State. However, site-specific assessments of natural or area background can still be initiated if desired. At least ten samples must be collected for a site-specific study into natural background and at least 20 are required for area background (Ch 173-340-708 11 (d) WAC).

Use of the Statewide and Regional Values

Statewide and regional 90th percentile values for the Puget Sound Basin, Clark County, Yakima Basin, and Spokane Basin are presented in **Table 6**. The statewide values can be used for any purpose (i.e., comparison against data from toxic waste sites, waste streams, etc.) and there are no restrictions on the use of this data. The regional 90th percentile values for Puget Sound, Clark County, Yakima Basin, and Spokane Basin are to be compared against data from those regions only (see Table 12 below).

Table 12: Counties Encompassed by Regional Background Values

Region	Counties
Puget Sound Basin	Clallam, Jefferson, Mason, Thurston, Pierce, King, Kitsap, Island, Snohomish
Clark County	Clark, Cowlitz, Skamania
Yakima Basin	Yakima, Kittitas, Klickitat, Chelan, Benton
Spokane Basin	Spokane, Lincoln, Adams, Whitman

Other Areas

Sites that are not located within the four main regional areas may use the statewide values or the 10 sampling locations (see latitude/longitude coordinates, data tables) that are closest to a given site or area.

Application of Background Values

When comparing cleanup- or contaminated-site data against background values, the 95 % upper confidence limit (UCL) of a given data set is compared against the 90th percentile of the background data set. Please refer to Ecology's publication entitled *Statistical Guidance for Ecology Site Managers* (August, 1992). Detailed instructions on how to derive soil cleanup standards based on background standards are included in that document. Please use caution when comparing individual data points against the 90th percentile value of the background data set. When comparing individual

data points against the 90th percentile value, there is a 10% chance that an individual data point will exceed the 90th percentile value.

Alternative Procedures

The 90th percentile has been selected by Ecology as the default assumption for determining background. If background values are used as cleanup levels, no single sample concentration shall be greater than two times the 90th percentile value and less than ten percent of the sample concentrations shall exceed the 90th percentile value (Ch 173-340-740 (7) (e), see Table 13).

However, alternative procedures for determining background are allowed. Specifically, a numerical cleanup standard is established, based on different data evaluation procedures. This could be the result of site-specific characteristics, such as the form of the background data distribution, its coefficient of variation (CV) or degree of skew, the number of samples available, or other such factors. For more information on alternative procedures for determining background, consultant Ecology's *Statistical Guidance for Site Managers* (August, 1992, see flowchart of p. 38 for alternative procedures).

TABLE 13: 90th PERCENTILE VALUES

ALL VALUES = MG/KG

	Al	As	Be	Cd	Cr	Cu
GROUP "W"	62,905	125,810	8.47	16.9	0.8	0.1
PUGET SOUND	32,581	65,162	7.30	14.6	0.6	0.2
CLARK COUNTY	52,276	104,552	5.81	11.6	2.1	0.8
WEST (ALL)	45,735	91,470	6.37	12.7	1.5	0.9
STATEWIDE	37,206	74,412	6.99	14.0	1.4	2.0
EAST (ALL)	28,299	56,598	7.61	15.2	1.3	0.8
YAKIMA BASIN	33,379	66,758	5.13	10.3	1.6	0.9
SPOKANE BASIN	21,376	42,752	9.34	18.7	0.8	1.4
GROUP "E"	25,591	51,182	5.76	11.5	0.6	N/A
				1.2	N/A	37.8
					N/A	75.6
						28.4
						56.8

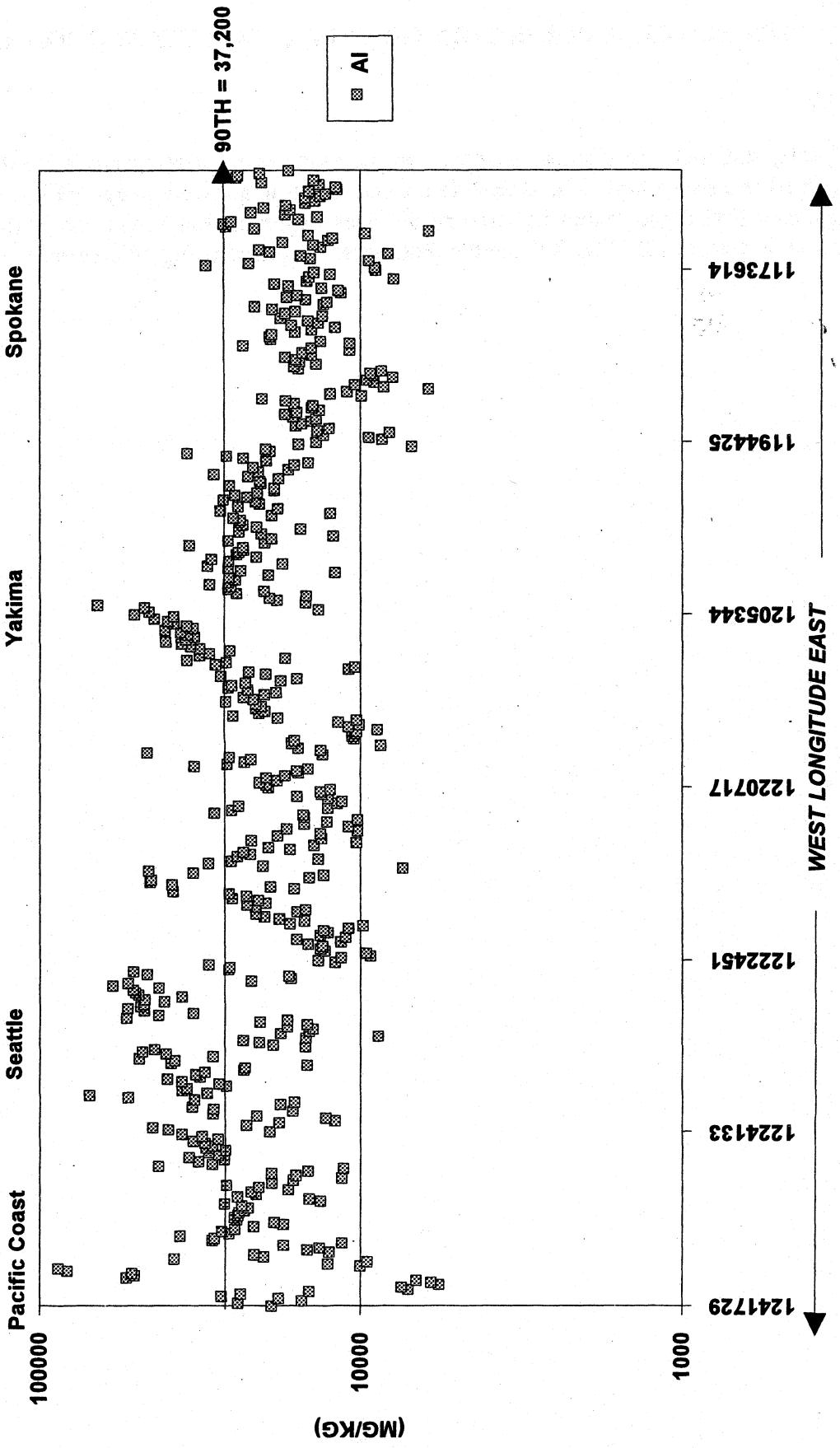
	Fe	Hg	Mn	Ni	Pb	Zn
GROUP "W"	49,170	98,340	0.13	0.26	691.8	1,384
PUGET SOUND	36,128	72,256	0.07	0.14	1146.0	2,292
CLARK COUNTY	58,665	117,330	0.04	0.08	1511.0	3,022
WEST (ALL)	50,125	100,250	0.08	0.16	1337.3	2,675
STATEWIDE	43,106	86,212	0.07	0.14	1094.9	2,190
EAST (ALL)	36,644	73,288	0.04	0.08	836.0	1,672
YAKIMA BASIN	51,451	102,902	0.05	0.10	1104.8	2,210
SPOKANE BASIN	25,026	50,052	0.02	0.04	663.5	1,327
GROUP "E"	29,631	59,262	0.02	0.04	526.6	1,053
				22.4	44.8	9.9
					11.0	22.0
					13.1	26.2
					10.0	20.0
					12.1	24.2
					13.1	26.2
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					12.1	24.2
					13.1	26.2
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IX. SCATTER PLOTS, DISTRIBUTION GRAPHS, & CONCENTRATION MAPS

Summary

Scatter plots, statistical distribution graphs, and statewide concentration maps for the 12 elements are presented in this section. The statewide concentration maps were prepared by Ecology's Environmental Investigation and Laboratory Services Program (EILS) via use of their geographic information system (GIS). The XY scatter plots were prepared using Microsoft Excel.

FIGURE 23: ALUMINUM X,Y SCATTER PLOT





> 40000 mg/kg



$\geq 20000 < 40000$ mg/kg

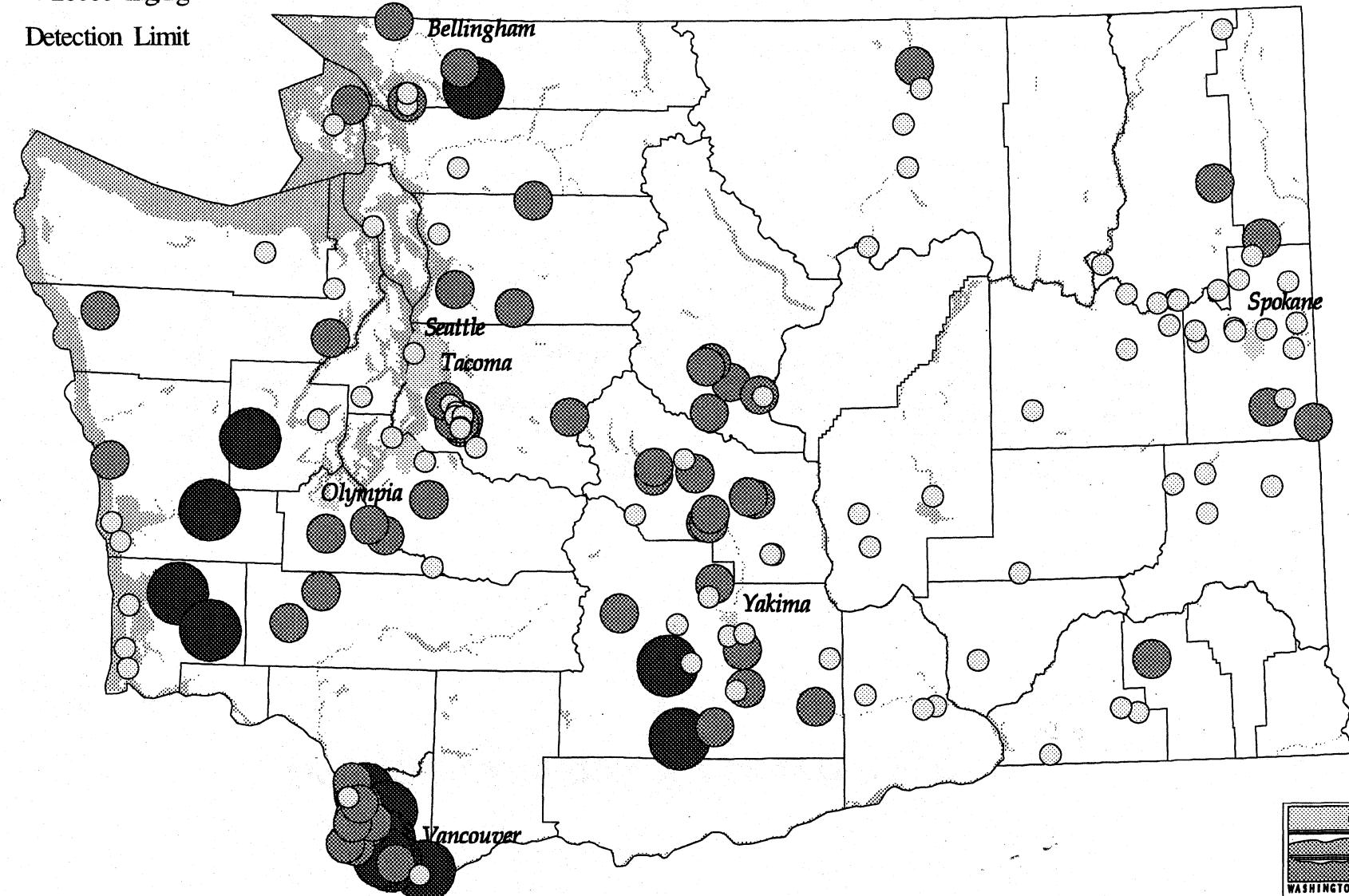


< 20000 mg/kg



Detection Limit

Figure 24: Aluminum Concentrations

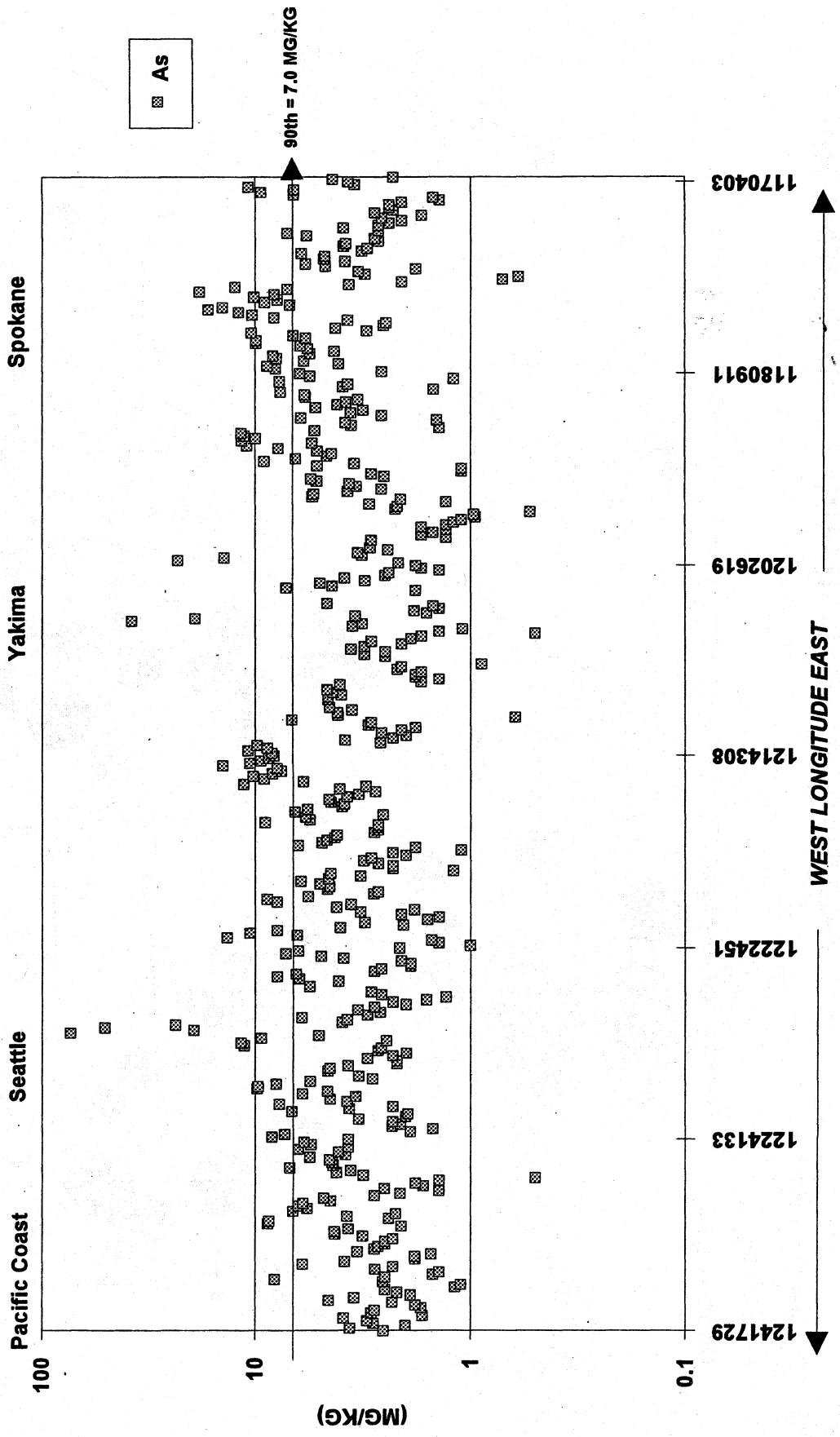


Map Prepared by EILS Program



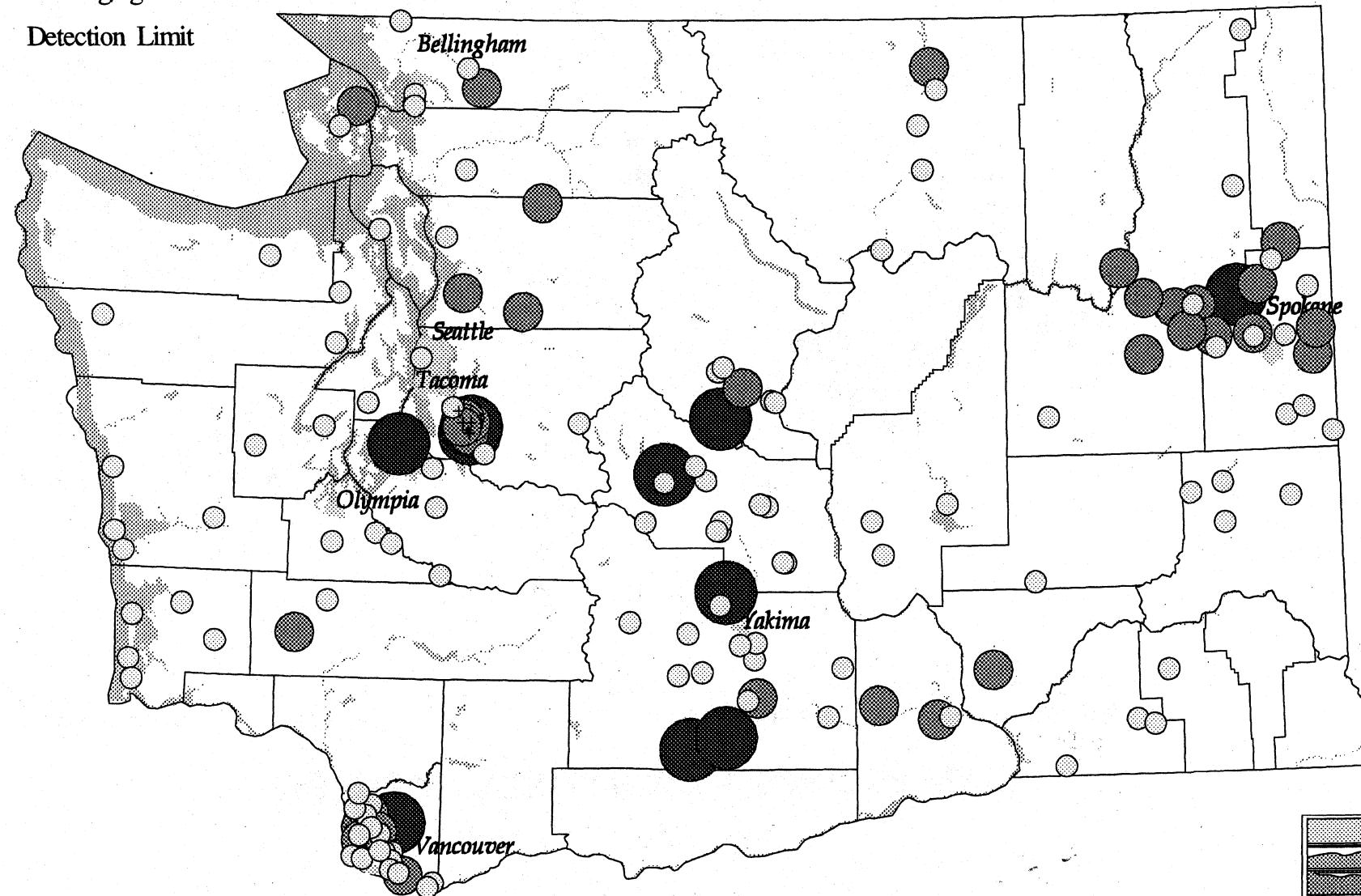
NOTE: PLOT IS BASED ON GRAPHITE FURNACE ATOMIC ABSORPTION (GFAA) ANALYSIS.

FIGURE 25: ARSENIC X,Y SCATTER PLOT



- $> 10 \text{ mg/kg}$
- $\geq 5 < 10 \text{ mg/kg}$
- $< 5 \text{ mg/kg}$
- + Detection Limit

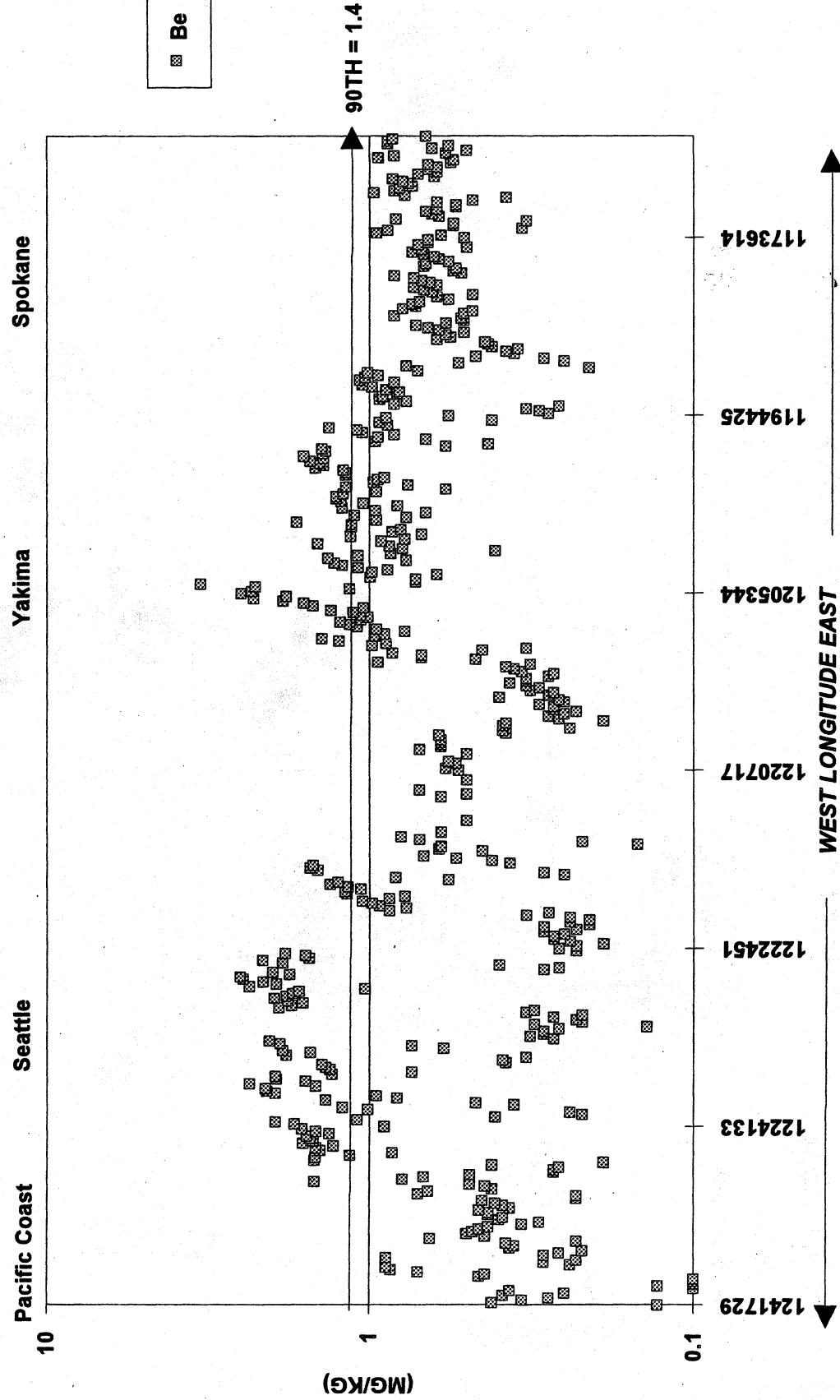
Figure 26: Arsenic Concentrations



Map Prepared by EILS Program

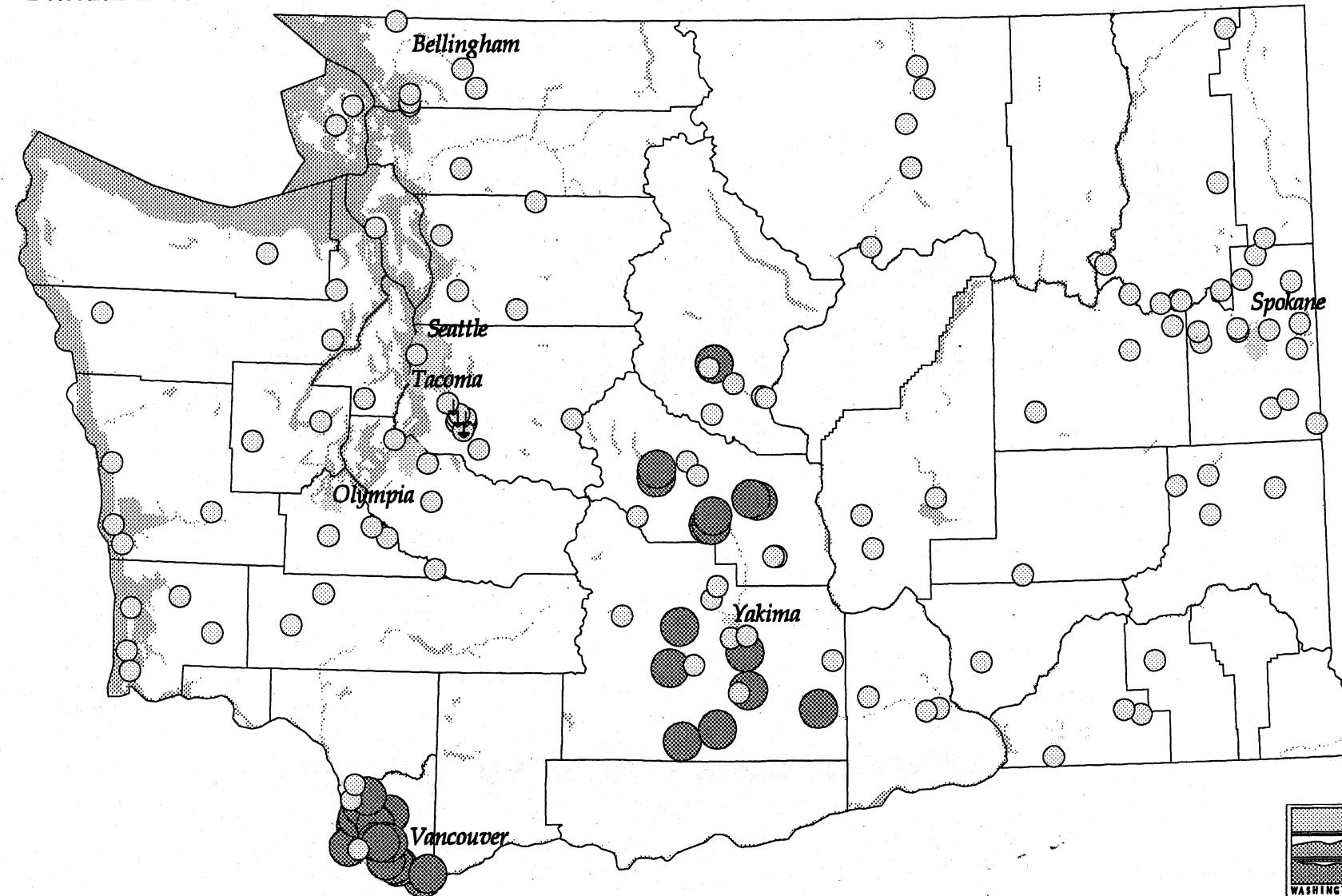


FIGURE 27: BERYLLIUM X,Y SCATTER PLOT



- $> 1 \text{ mg/kg}$
- $< 1 \text{ mg/kg}$
- ↓ Detection Limit

Figure 28: Beryllium Concentrations



Map Prepared by EILS Program



FIGURE 29: CADMIUM X,Y SCATTER PLOT

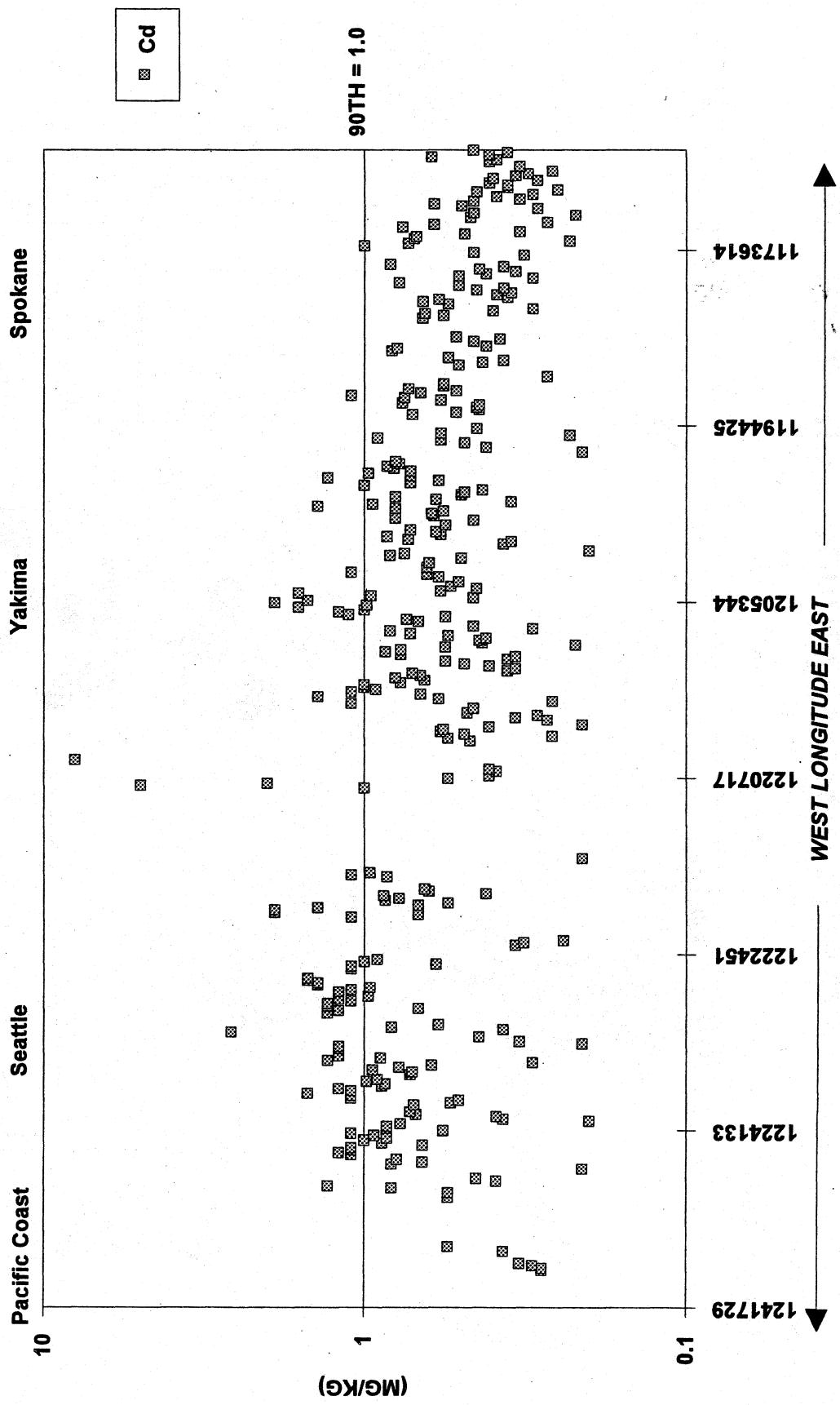


Figure 30: Cadmium Concentrations

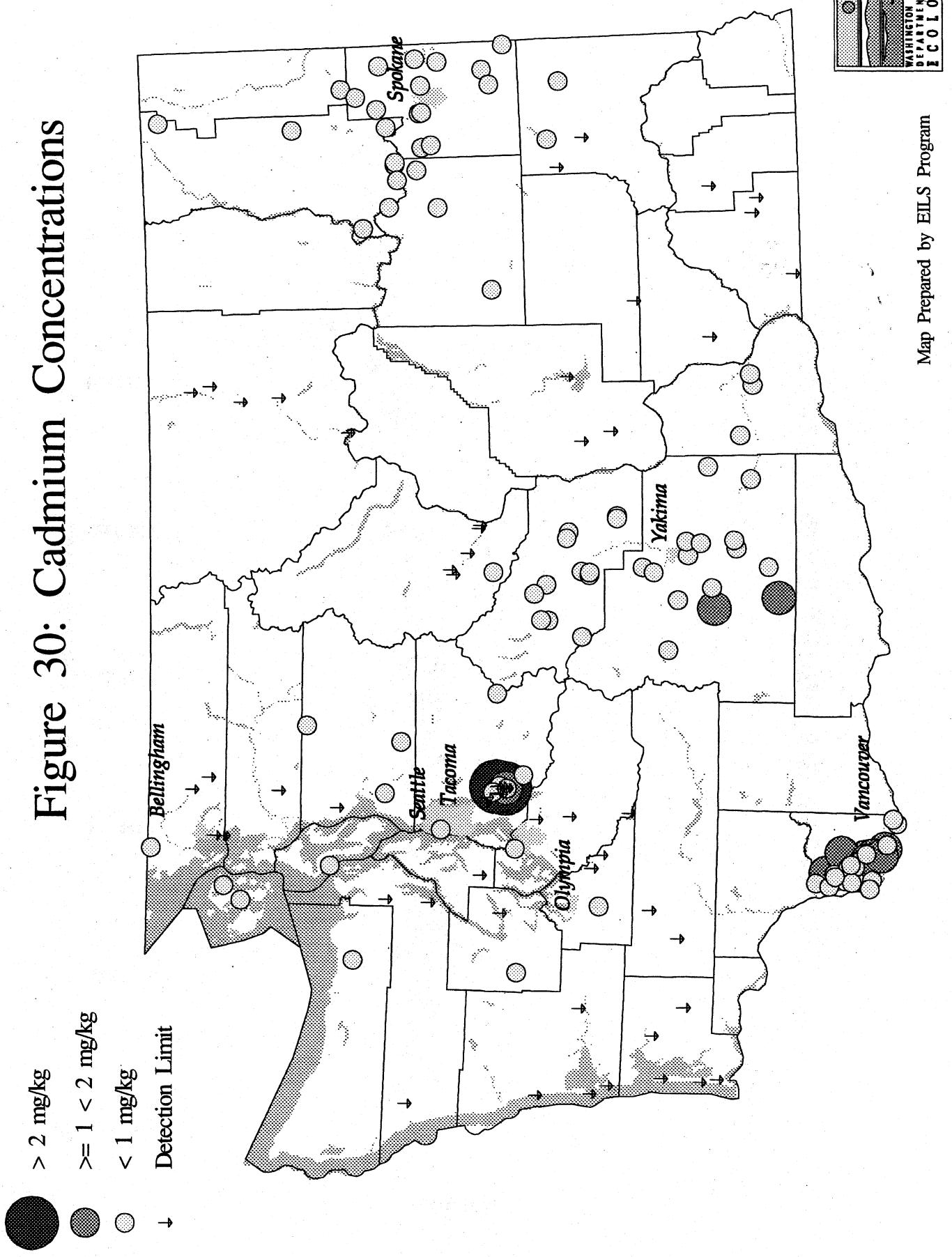
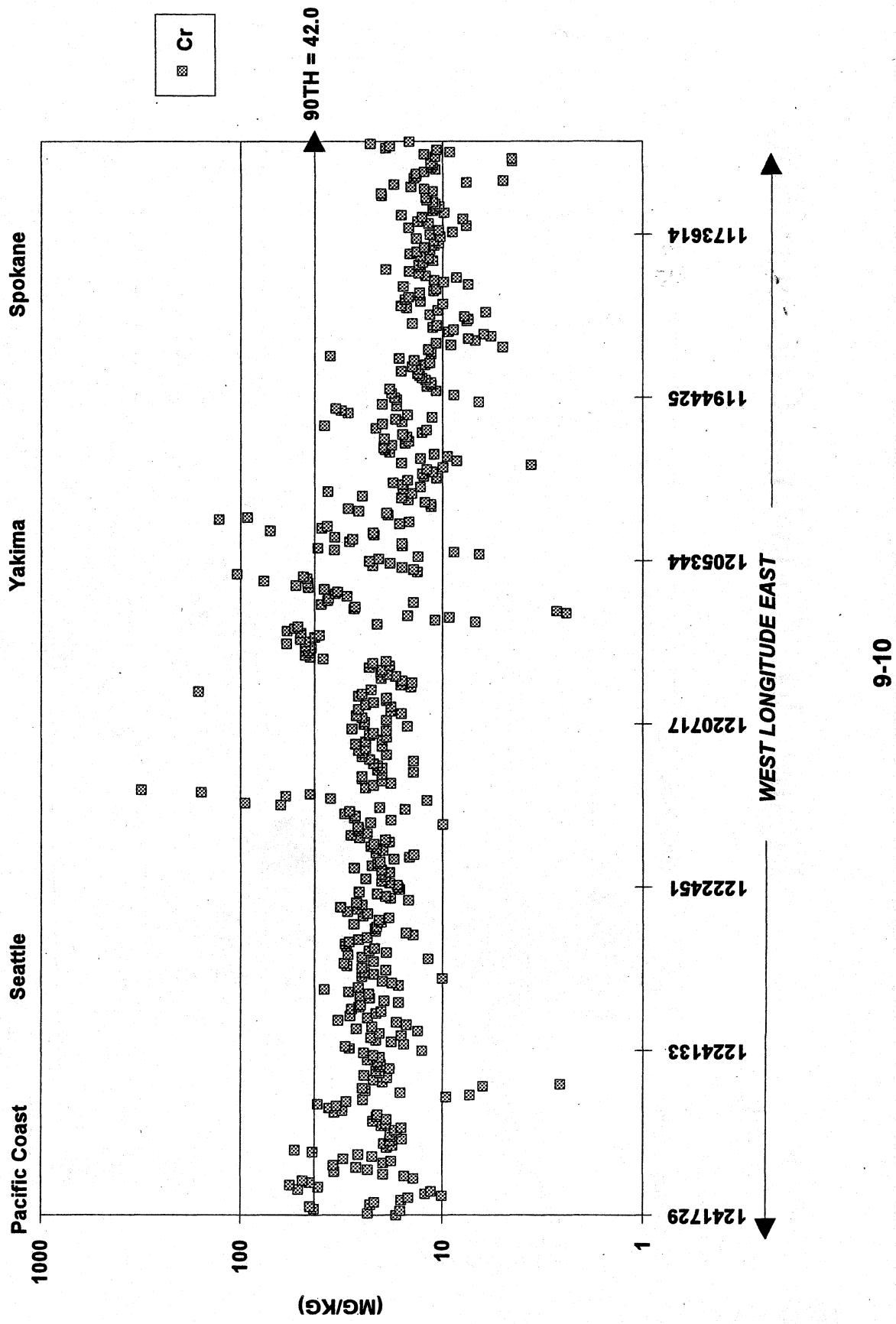


FIGURE 31: CHROMIUM X,Y SCATTER PLOT





> 30 mg/kg



>= 20 < 30 mg/kg

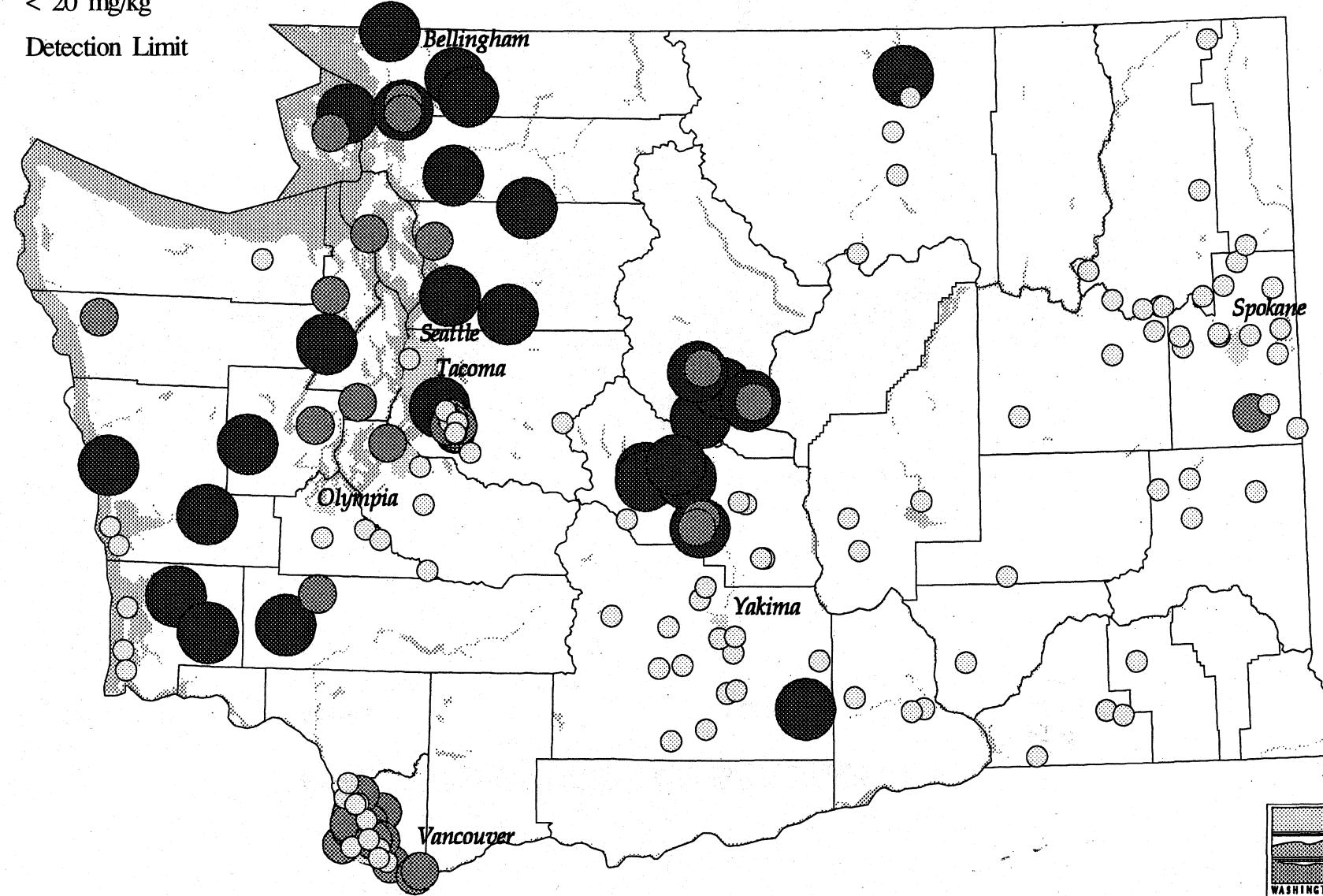


< 20 mg/kg



Detection Limit

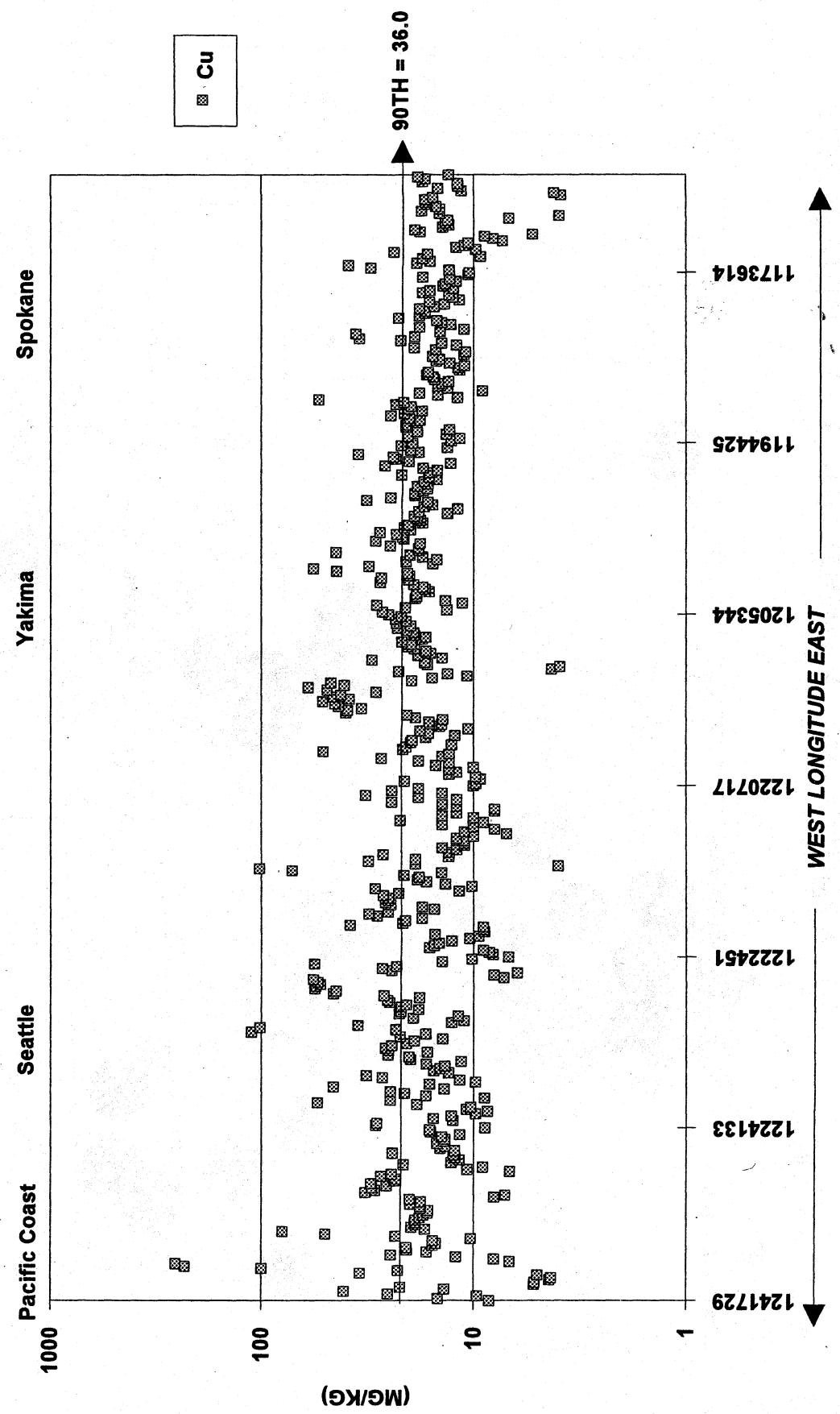
Figure 32: Chromium Concentrations



Map Prepared by EILS Program

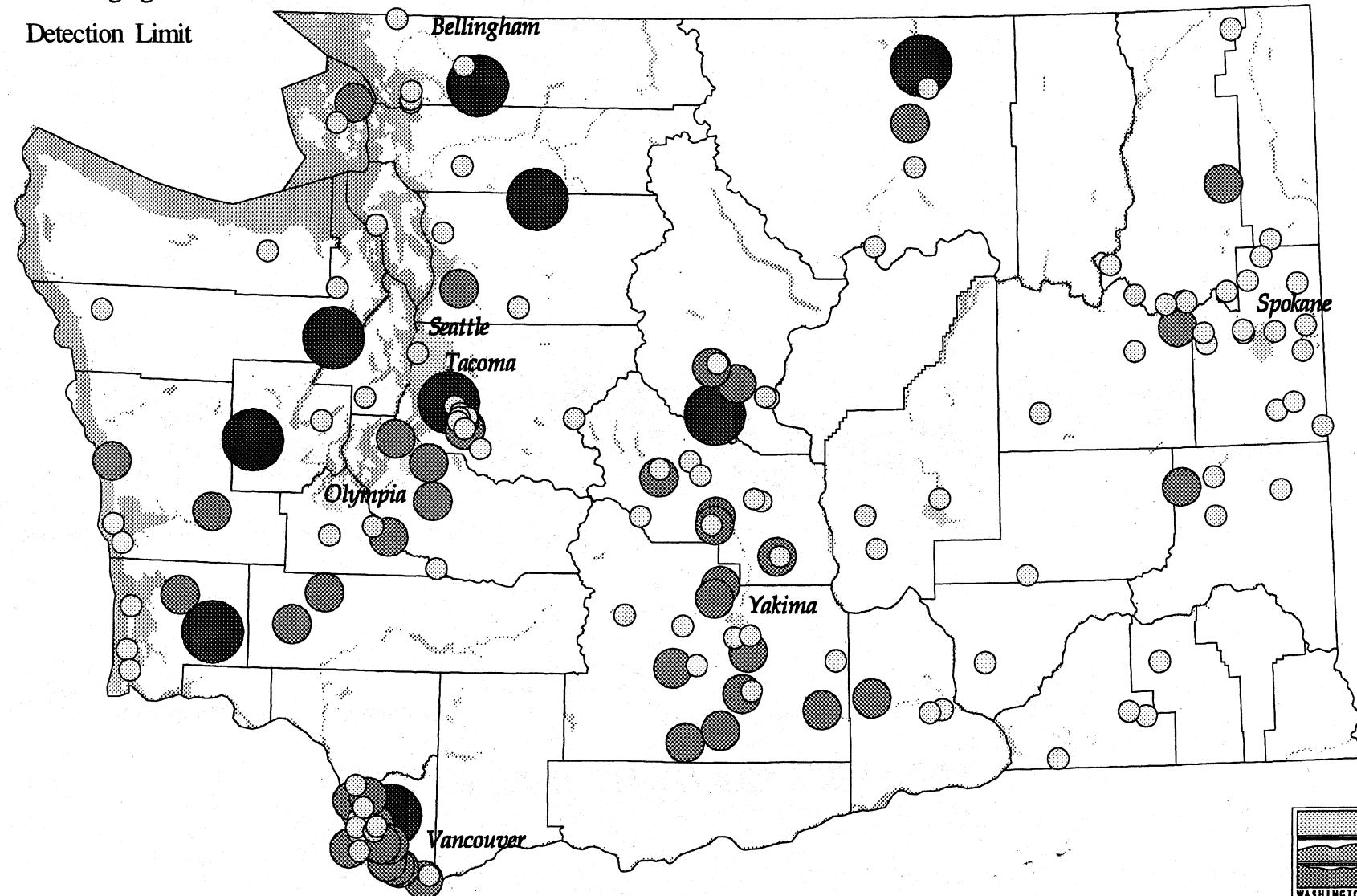


FIGURE 33: COPPER X,Y SCATTER PLOT



- $> 40 \text{ mg/kg}$
- $\geq 20 < 40 \text{ mg/kg}$
- $< 20 \text{ mg/kg}$
- ↓ Detection Limit

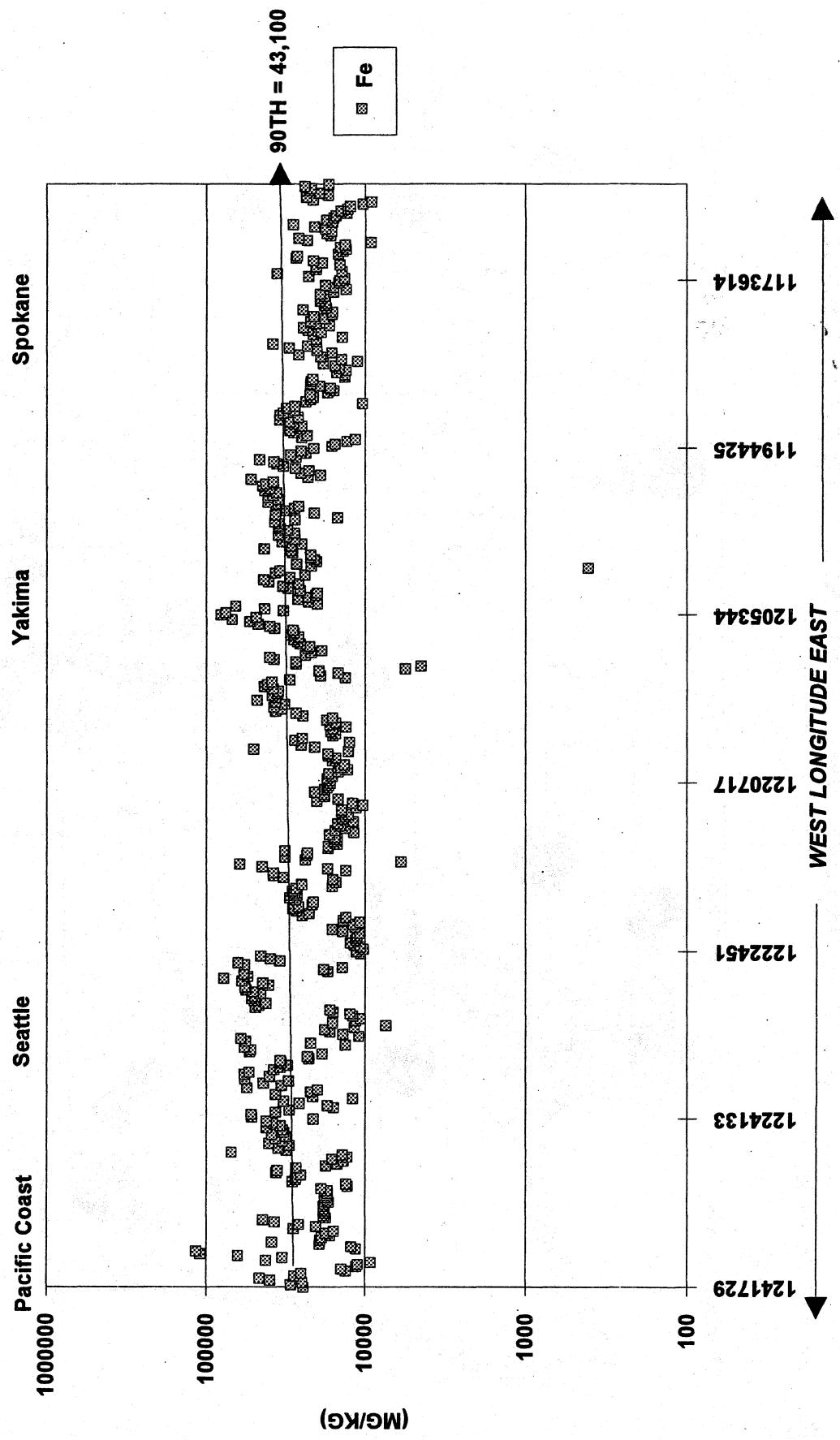
Figure 34: Copper Concentrations



Map Prepared by EILS Program

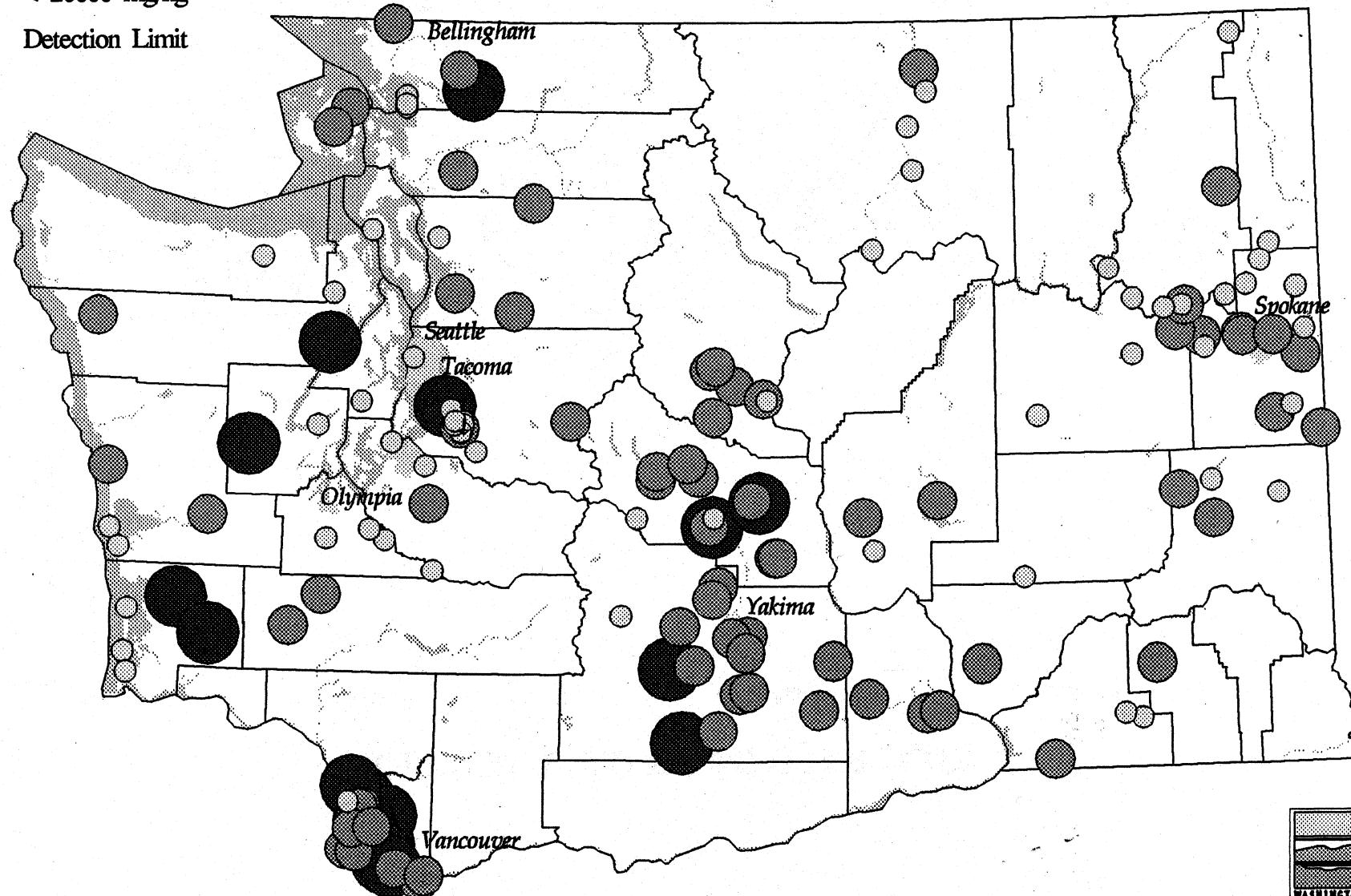


FIGURE 35: IRON X,Y SCATTER PLOT



- $> 40000 \text{ mg/kg}$
- $\geq 20000 < 40000 \text{ mg/kg}$
- $< 20000 \text{ mg/kg}$
- ↓ Detection Limit

Figure 36: Iron Concentrations



Map Prepared by EILS Program

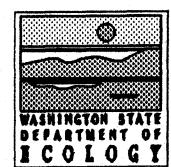
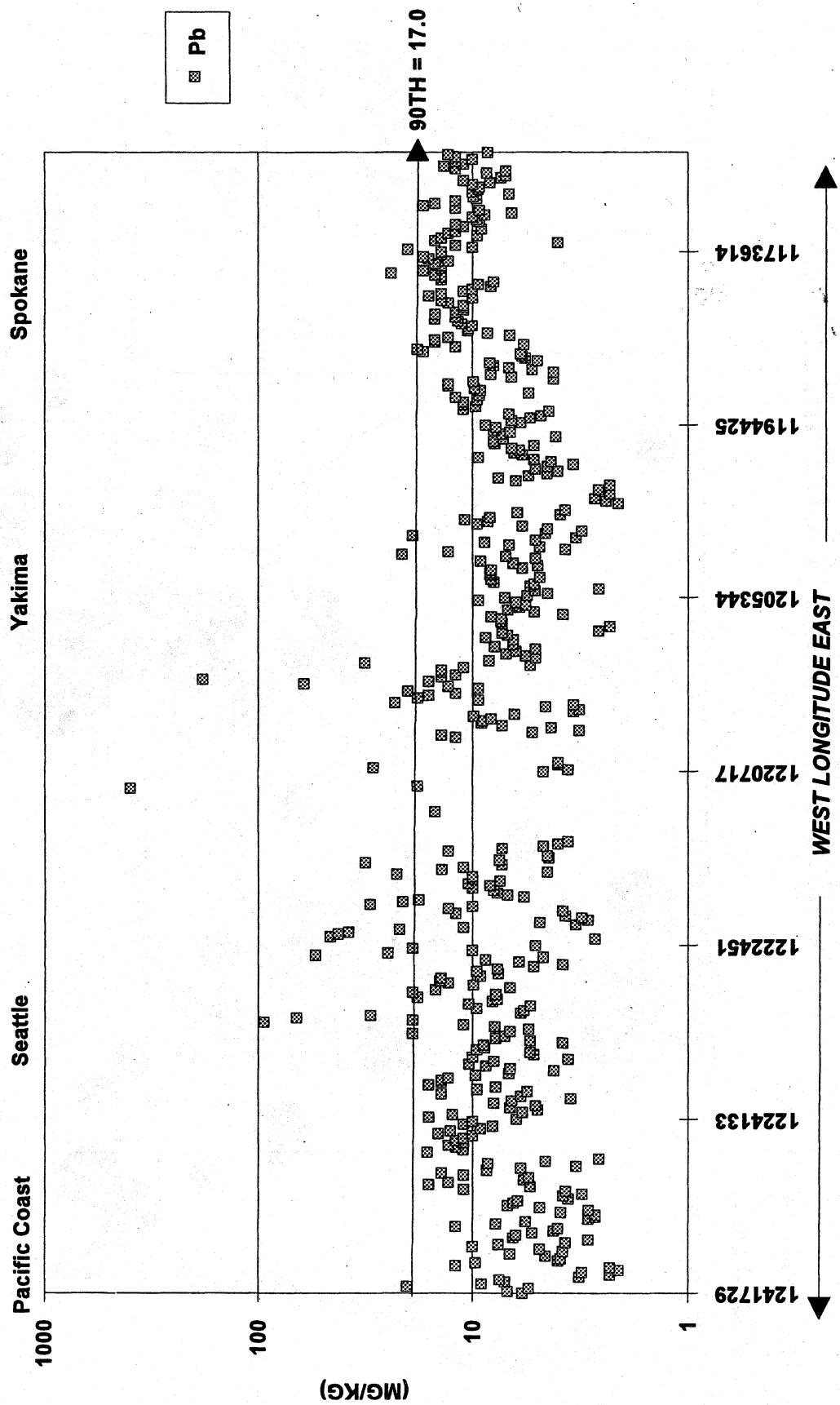
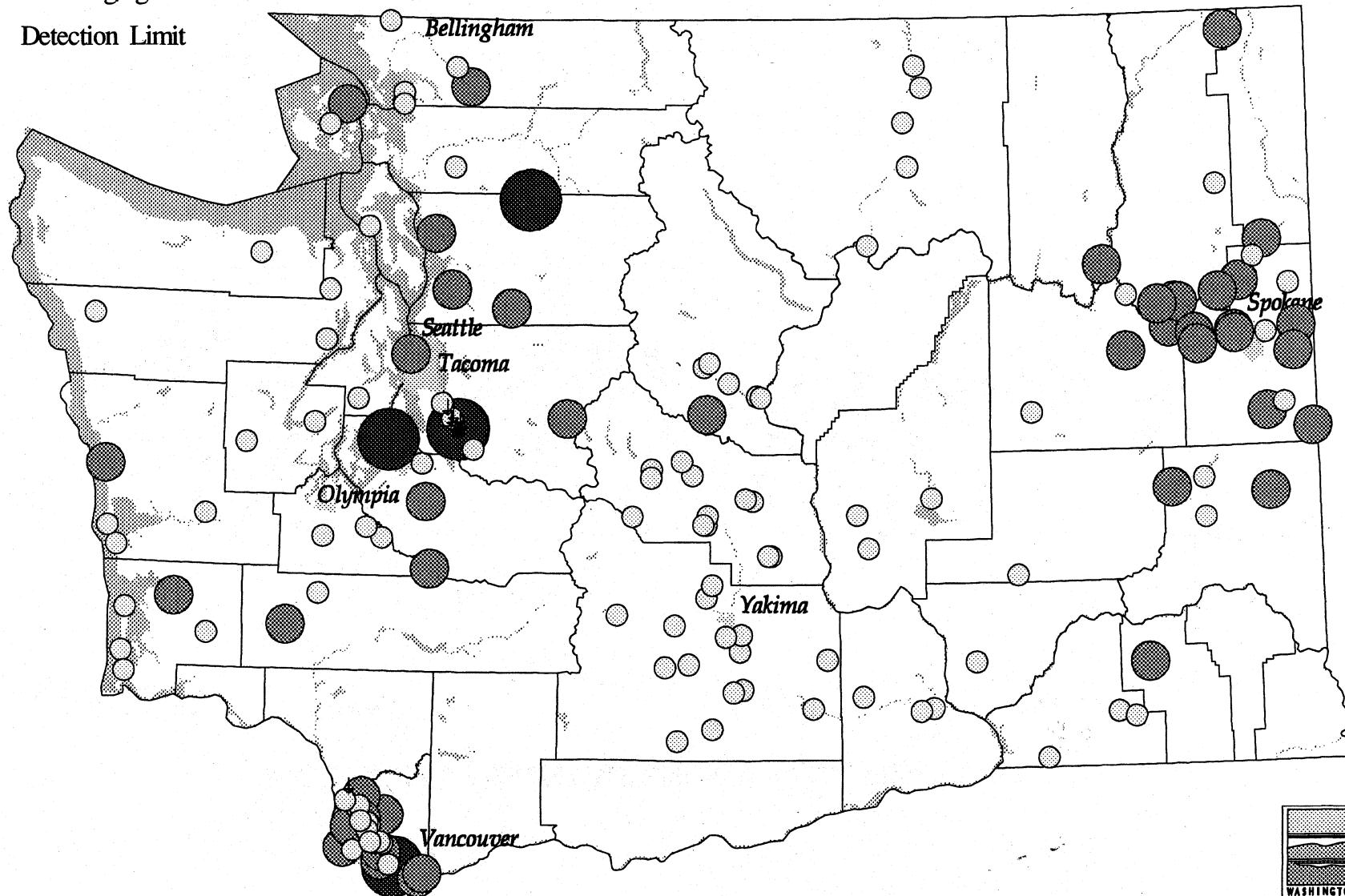


FIGURE 37: LEAD X,Y SCATTER PLOT



- $> 20 \text{ mg/kg}$
- $\geq 10 < 20 \text{ mg/kg}$
- $< 10 \text{ mg/kg}$
- ↓ Detection Limit

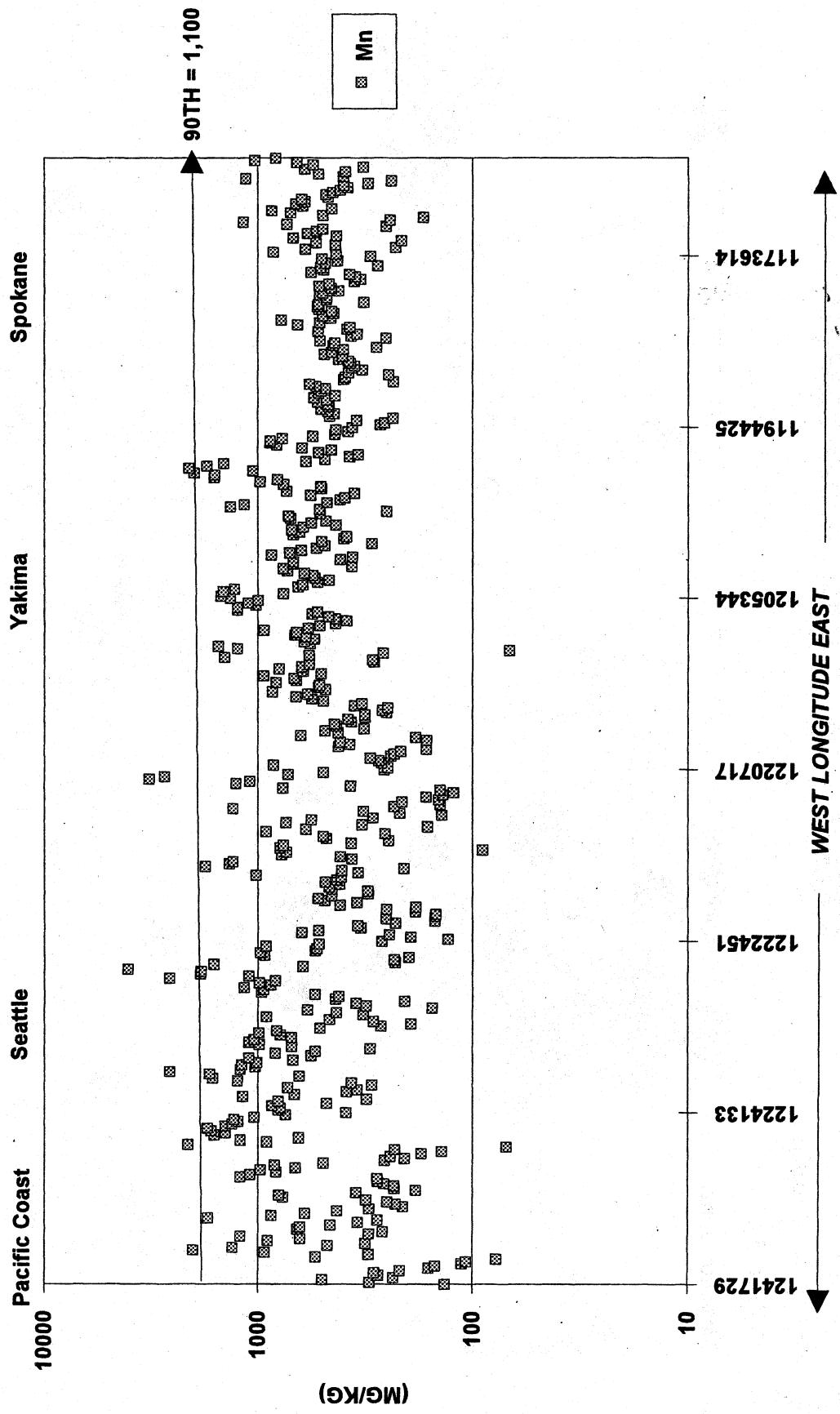
Figure 38: Lead Concentrations



Map Prepared by EILS Program

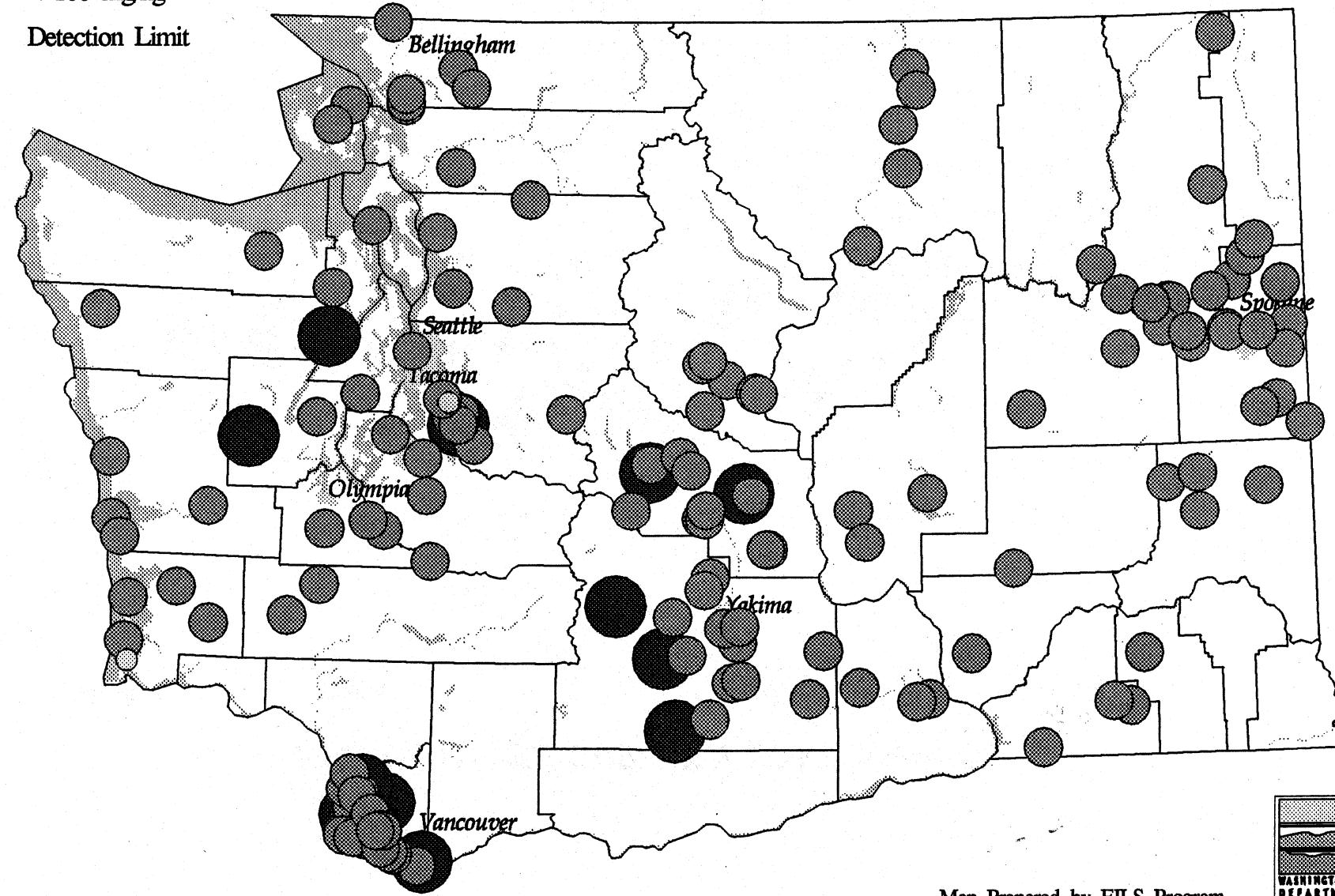


FIGURE 39: MANGANESE X,Y SCATTER PLOT



- $> 1000 \text{ mg/kg}$
- $\geq 100 < 1000 \text{ mg/kg}$
- $< 100 \text{ mg/kg}$
- ↓ Detection Limit

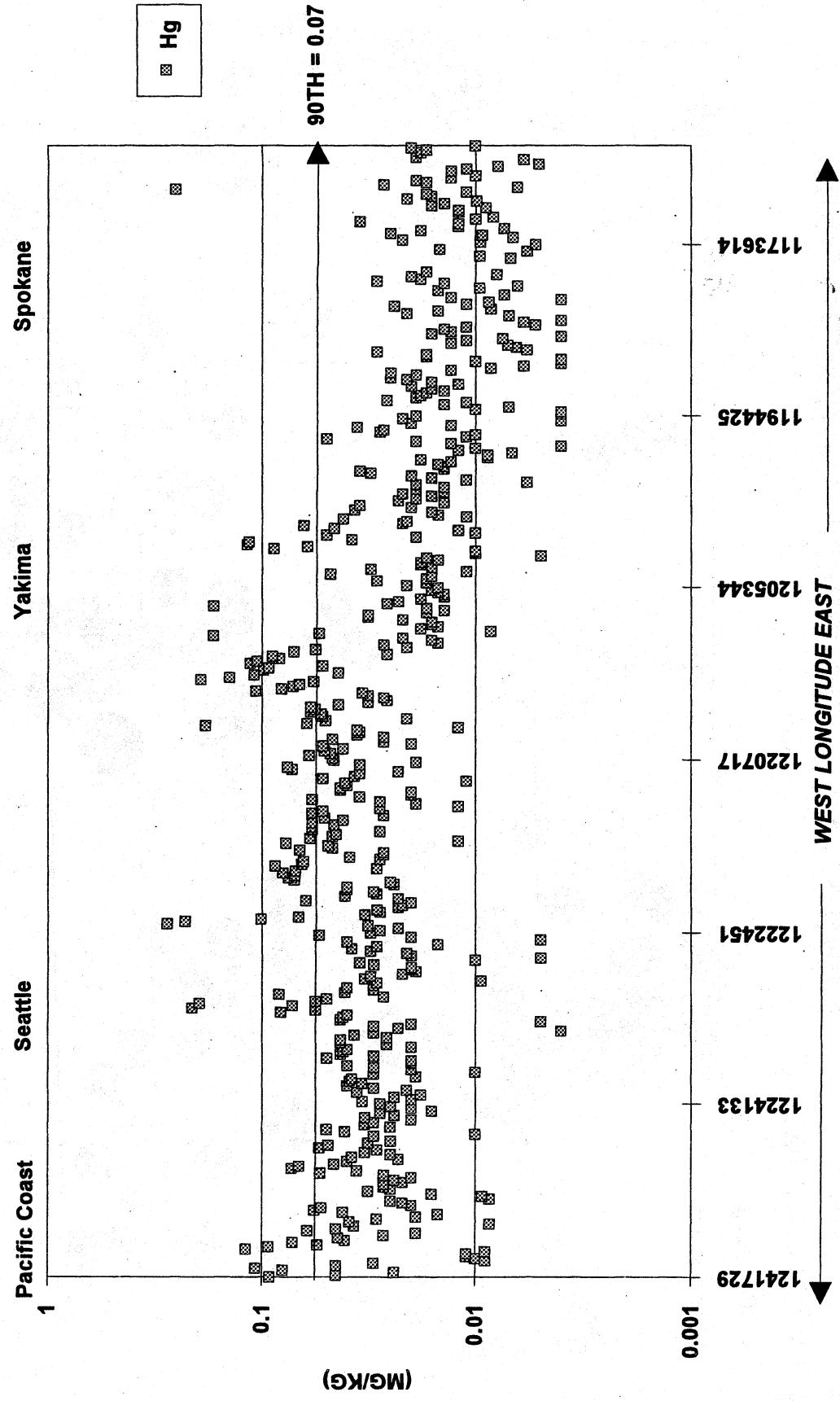
Figure 40: Manganese Concentrations



Map Prepared by EILS Program



FIGURE 41: MERCURY X,Y SCATTER PLOT





> .1 mg/kg



>=.01 < .1 mg/kg

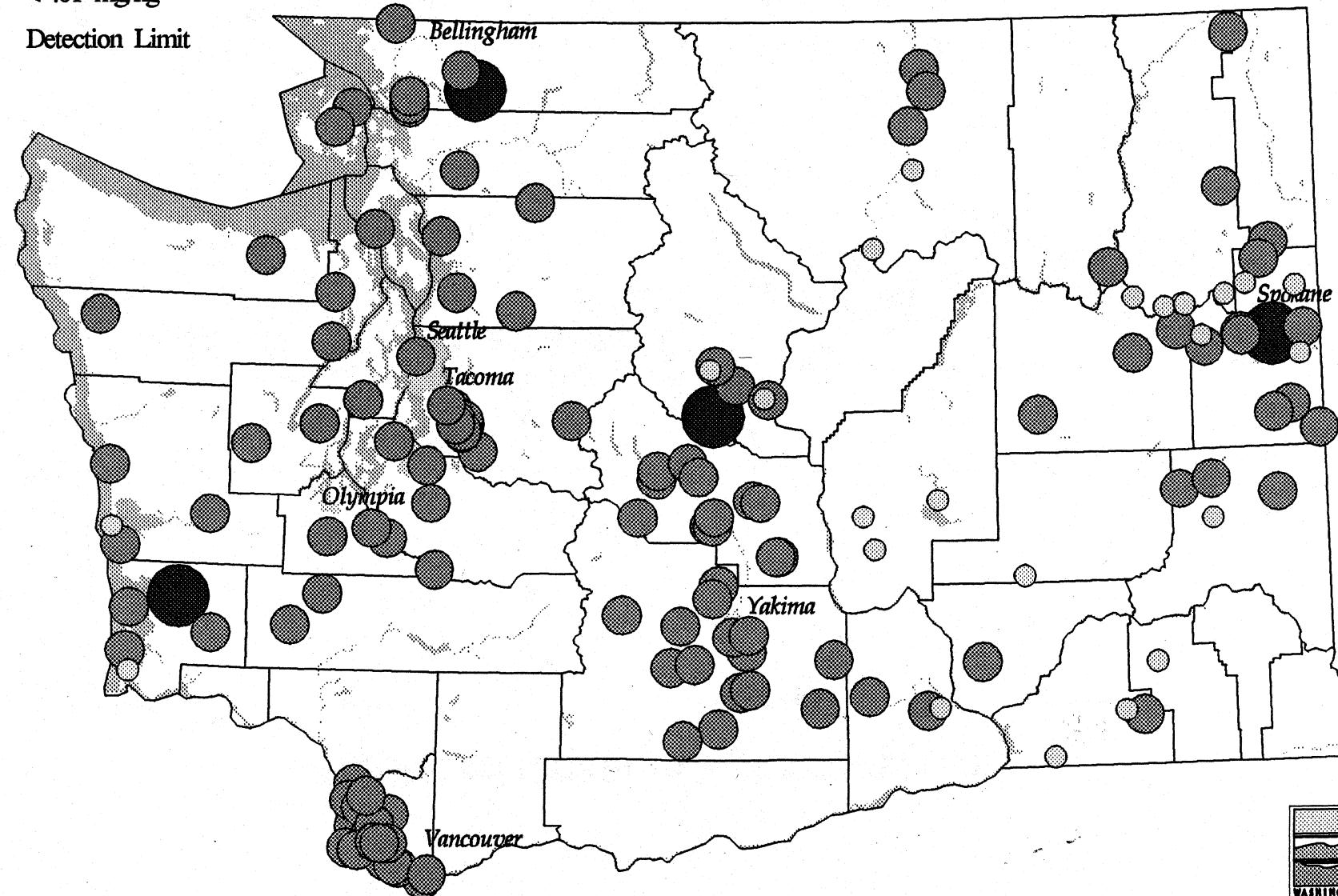


< .01 mg/kg



Detection Limit

Figure 42: Mercury Concentrations



Map Prepared by EILS Program

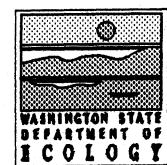
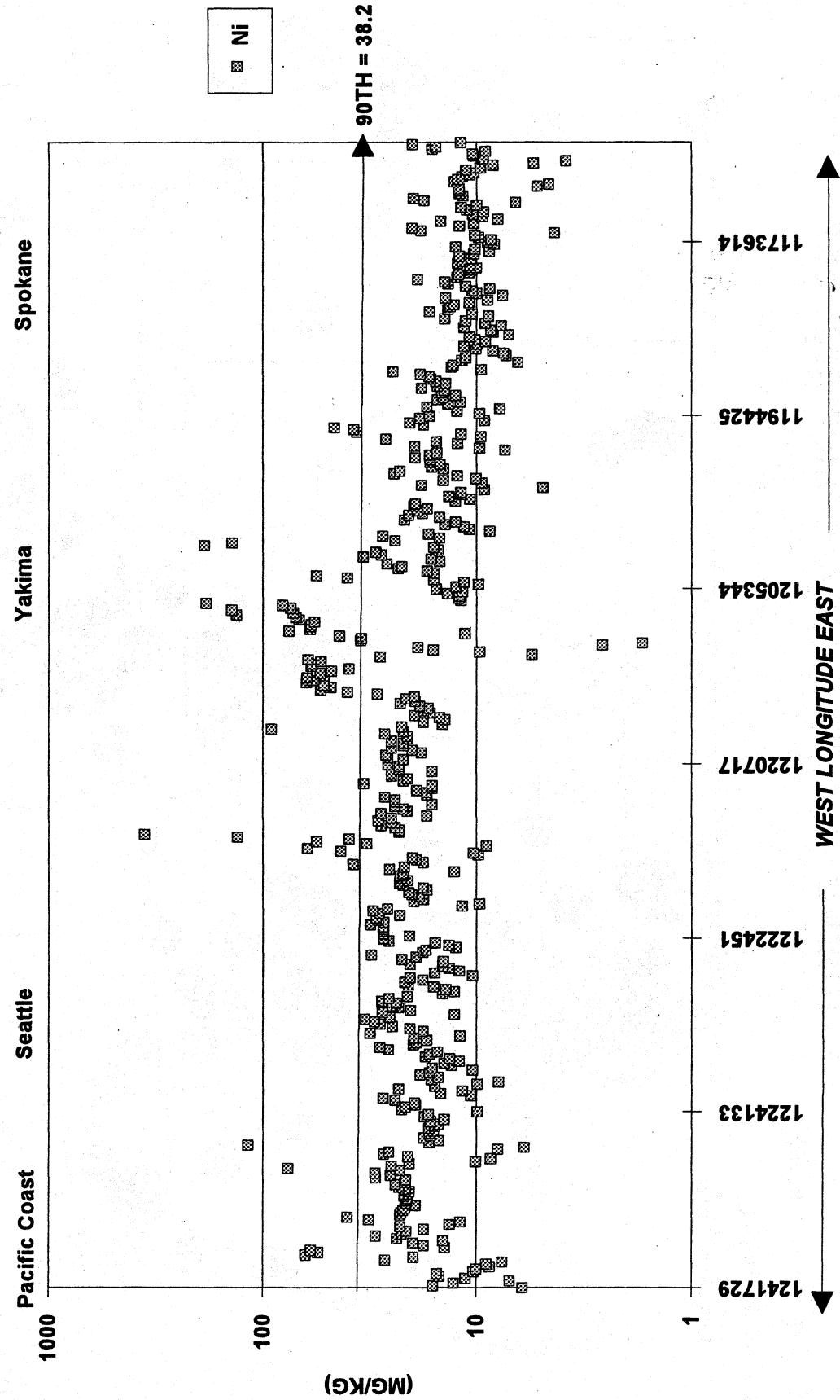
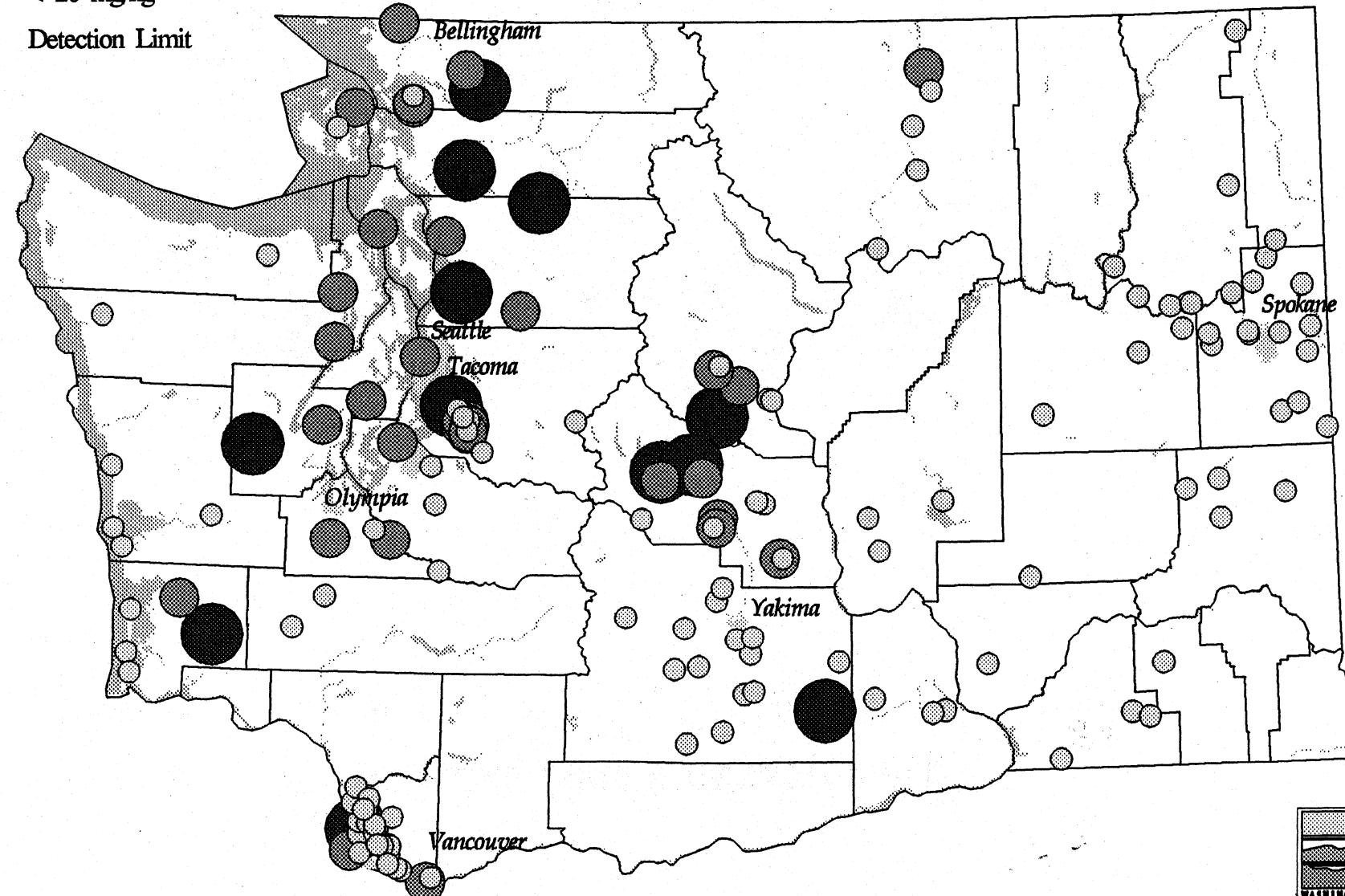


FIGURE 43: NICKEL X,Y SCATTER PLOT



- $> 40 \text{ mg/kg}$
- $\geq 20 < 40 \text{ mg/kg}$
- $< 20 \text{ mg/kg}$
- ↓ Detection Limit

Figure 44: Nickel Concentrations



Map Prepared by EILS Program

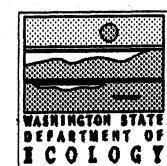
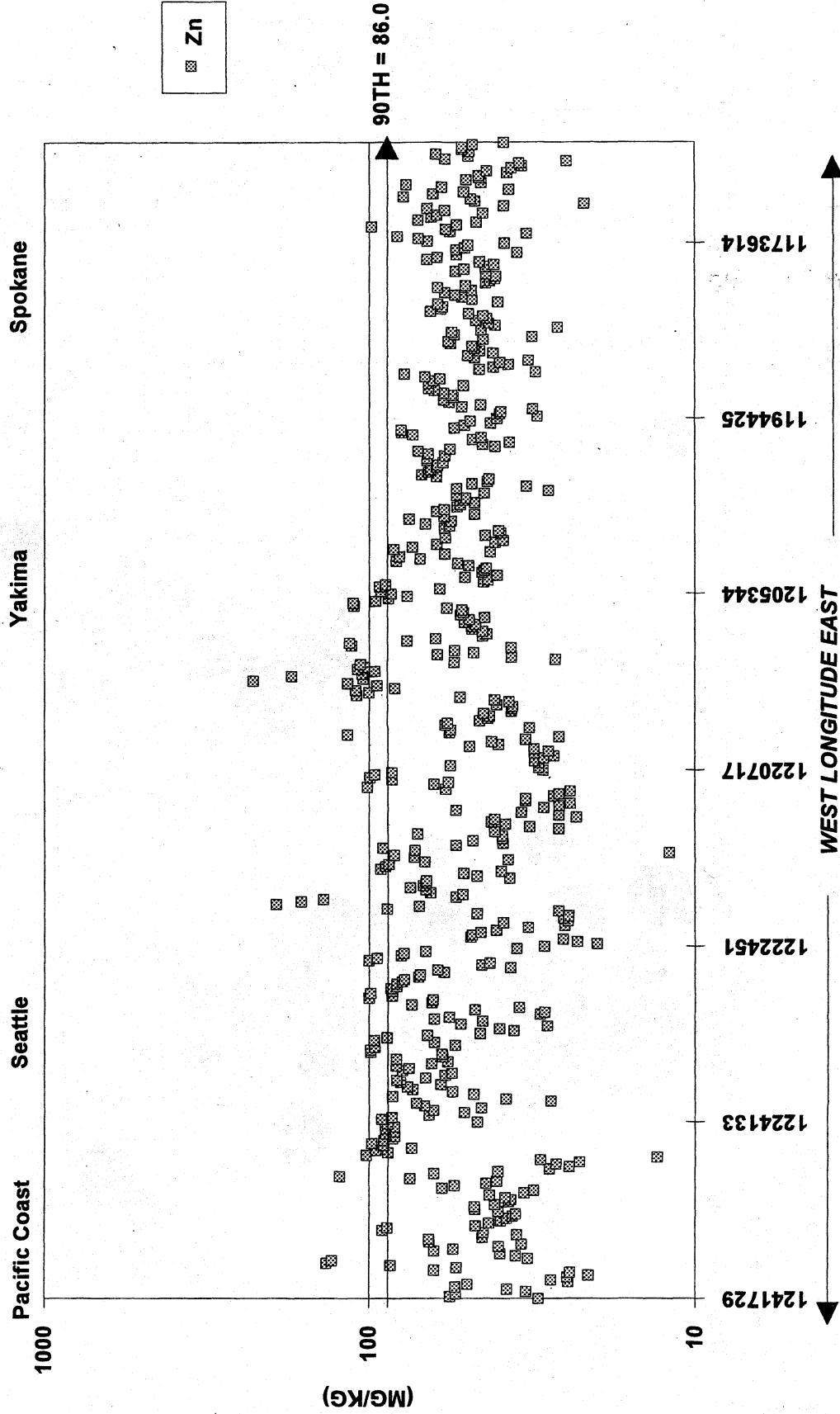
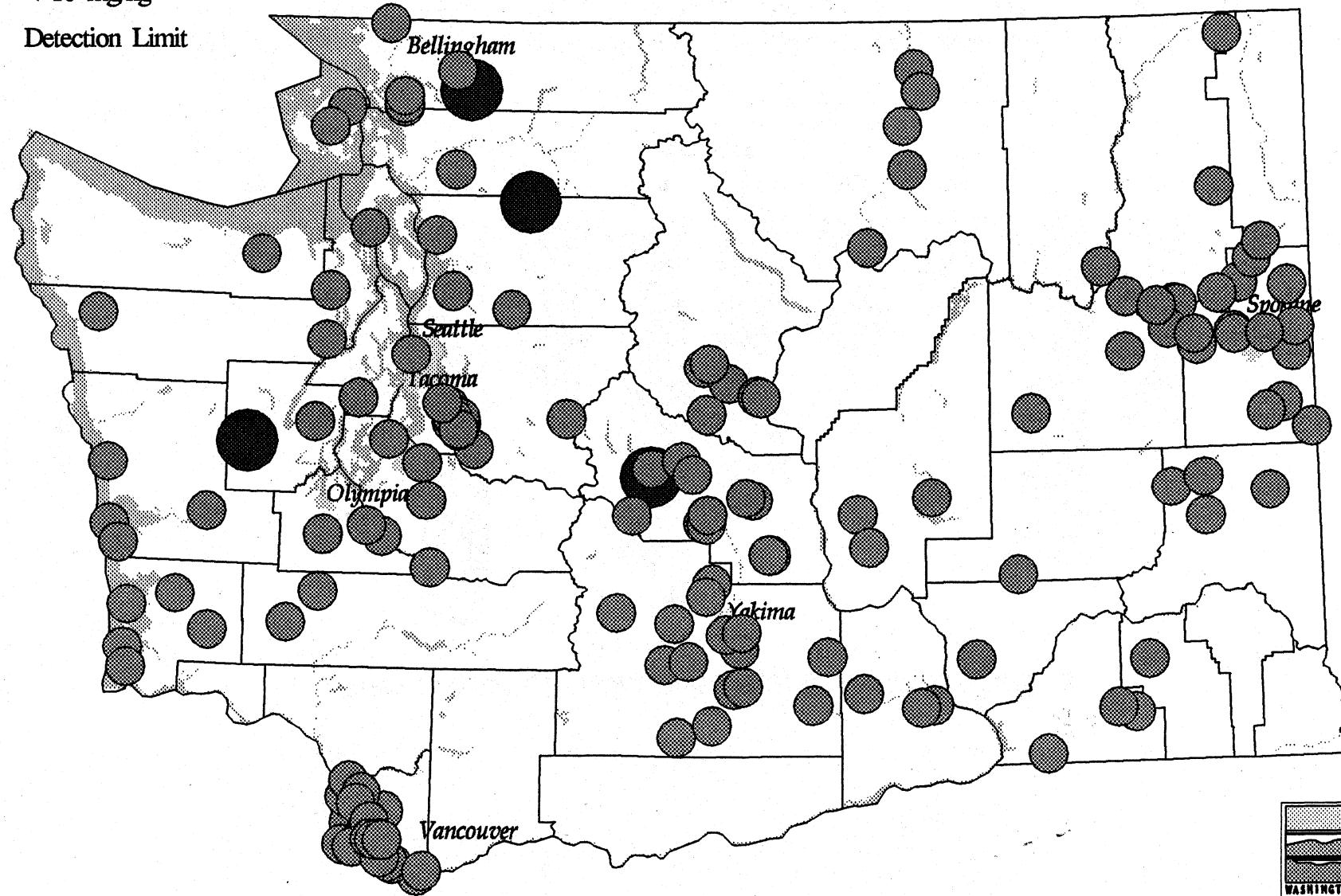


FIGURE 45: ZINC X,Y SCATTER PLOT



- $> 100 \text{ mg/kg}$
- $\geq 10 < 100 \text{ mg/kg}$
- $< 10 \text{ mg/kg}$
- ↓ Detection Limit

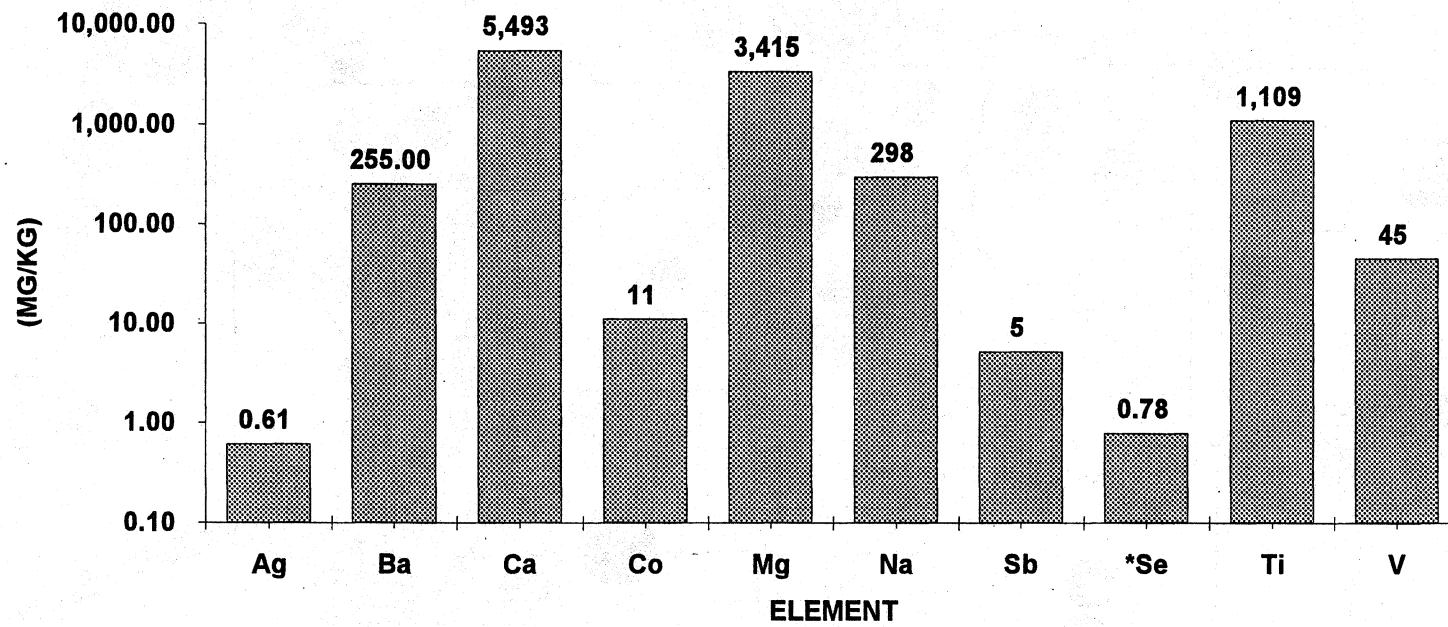
Figure 46: Zinc Concentrations



Map Prepared by EILS Program



FIGURE 47: 90th PERCENTILE VALUES - OTHER ELEMENTS



	Ag	Ba	Ca	Co	Mg	Na	Sb	*Se	Ti	V
90th Percentile	0.61	255.00	5,493	11	3,415	298	5	0.78	1,109	45
Population (n)	33	72	72	72	72	69	50	14	72	72
Detection Limit	0.3						3	0.19		
Number > Detection Limit	33						50	14		

* Se 90th BASED ON ATOMIC ABSORPTION (AA) ANALYSIS.

Note: Ba, Ca, Co, Mg, Na, Ti, V data from Spokane Basin Only. Data may not be representative of statewide conditions.

X. DATA TABLES

Data Retrieval

All of the Manchester Laboratory analytical data for this project was obtained and retrieved electronically for QA/QC purposes. A data extraction program known as "Monarch" was then used to compile the data into spreadsheet form. Microsoft Excel was then used to compile all of the data into a spreadsheet format.

Interpreting the Data Tables

Two sets of data tables have been included. The first set contains values for Al - Fe. The second set contains data for Pb - Zn. All of the data table values are in units of parts per million or mg/kg. A brief description of each column in the data table is presented below.

Latitude and Longitude

Latitude and longitude coordinates have been assigned to all 166 sampling locations (first two columns, data tables).

Site Codes

The column entitled "Site" contains an alpha-numeric code for each sampling location. Each site code can be broken down into four parts: primary code, regional code, sample location number, and sample depth. Example site codes and their definitions are given in Table 14 below. Not every sample has all four parts; for example, samples collected in the 12-region study do not have a primary code. Several samples have a suffix with the letters "SS," "DUP," "V," or "RS." Definitions for these codes are given in Table 15.

Table 14: Site Code Definitions (read table left to right).

Site Code	Primary Code	Regional Code	Sample Location	Sample Depth
"SWRA2.5"	SW = Statewide	RA = Region "A"	N/A	2.5 = feet
"PSL2A0.5"	PSL = Puget Sound, Soos Creek	N/A	No. 2	0.5 = feet
"CL81.4V"	CL = Clark County	N/A	No. 8	1.4 = feet V = Vertical Profile Sample
"PS20.3"	PS = Puget Sound	N/A	No. 2	0.3 = feet
"SB310.3SS"	SB = Spokane Basin	N/A	No. 31	0.3 = feet "SS" = Sample Split
"YBRO2.5"	YB = Yakima Basin	RO = Region "O"	N/A	2.5 = feet

Table 15: Site Code Suffix Definition

Suffix	Definition
"V"	Vertical Profile Sample
"SS"	Sample Split
"DUP"	Duplicate Sample

Number Column

The Manchester sample number is given in this column. The first two digits give the year in which the sample was analyzed. The area in which a sample was collected can also be identified by sample number; i.e., all of the Soos Creek work was done in 1987, the 12-region study was completed in 1990, etc.(see Table 16 below)

Table 16: Background Soil Metals Study Chronology

Study	Completed In
Soos Creek	1987
Twelve Region	1990
Clark County	1991
Yakima Basin	1991
Spokane Basin	1992
Puget Sound Basin	1993

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

STN	LOC	SITE	NO.	Al	Ba	Be	Cd	Cr	Cu	Fs	Fs
463937	1234536	SWRA2.5	90478080	53,500	63,500	4.55	4.55	0.46	0.46	<0.2	51.5
465952	1233542	SWRA2.5	90478081	50,500	60,500	3.48	3.48	0.44	0.44	<0.2	41.2
463110	1233352	SWRA2.5	90478082	51,500	61,500	1.9	1.9	0.71	0.71	<0.2	56.7
464120	1225527	SWRA2.3	90478083	28,800	28,800	1.8	1.8	0.65	0.65	<0.2	26
463337	1230623	SWRA2.3	90478084	37,800	37,800	8.12	8.12	0.89	0.89	<0.2	34.2
465553	1240957	SWRC2.5	90478086	7,070	7,070	2.9	2.9	0.1	0.1	<0.2	16
465125	1240634	SWRC2.6	90478087	7,450	7,450	2.8	2.8	0.13	0.13	<0.2	14.8
463628	1240232	SWRC2.6	90478088	6,020	6,020	1.8	1.8	0.1	0.1	<0.2	12.2
462602	1240317	SWRC2.5	90478089	5,670	5,670	1.7	1.7	0.1	0.1	<0.2	10.1
462116	1240157	SWRC2.5	90478090	6,680	6,680	2.32	2.32	0.1	0.1	<0.2	11.4
483954	1222930	SWRD2.3	90478092	21,700	21,700	2.8	2.8	0.29	0.29	<0.2	32
483908	1222926	SWRD2.3	90478093	16,600	16,600	1.9	1.9	0.4	0.4	<0.2	26.7
484152	1222929	SWRD2.6	90478094	16,400	16,400	2.6	2.6	0.26	0.26	<0.2	25.1
484809	1221033	SWRD2.7	90478095	25,100	25,100	4.65	4.65	0.6	0.6	<0.2	45.2
484332	1220527	SWRD2.6	90478096	46,100	46,100	8.99	8.99	0.61	0.81	<0.2	163
484833	1192416	SWRJ2.7	90478107	20,100	20,100	5.28	5.28	0.71	0.71	<0.2	35.9
483446	1192836	SWRJ3	90478108	13,000	13,000	1.1	1.1	0.33	0.33	<0.2	10.8
480522	1194153	SWRJ2.8	90478109	9,430	9,430	2.9	2.9	0.3	0.3	<0.2	17.9
482415	1192705	SWRJ3.2	90478110	8,130	8,130	1.1	1.1	0.26	0.26	<0.2	18.3
484313	1192153	SWRJ3	90478111	9,940	9,940	1.4	1.4	0.21	0.21	<0.2	11.4
473642	1204021	SWRL2.7	90478112	25,600	25,600	0.5	0.5	0.77	0.77	<0.2	71.3
473251	1203128	SWRL2.7	90478113	25,700	25,700	7.19	7.19	0.77	0.77	<0.2	36.9
473740	1203824	SWRL2.7	90478114	29,000	29,000	1.4	1.4	1.14	1.14	<0.2	29.3
472924	1202000	SWRL2.7	90478115	16,700	16,700	2.25	2.25	0.43	0.43	<0.2	20
472943	1202117	SWRL2.6	90478116	20,700	20,700	0.53	0.53	0.58	0.59	<0.2	38.4
470608	1175445	SWRP2.8	90478128	18,900	18,900	4.1	4.1	0.79	0.79	<0.2	15.4
465848	1174302	SWRP3.	90478129	14,800	14,800	3.73	3.73	0.54	0.54	<0.2	12.6
462437	1180414	SWRP3	90478130	23,100	23,100	2.6	2.6	0.84	0.84	<0.2	16.1
461153	1180928	SWRP3	90478131	15,100	15,100	1.2	1.2	0.58	0.58	<0.2	6.1
461307	1181528	SWRP3.2	90478132	15,400	15,400	1.49	1.49	0.51	0.51	<0.2	7.6
470446	1191953	SWRR2.5	90478134	6,140	6,140	1.44	1.44	0.25	0.25	<0.2	5
470053	1194611	SWRR2.7	90478135	6,930	6,930	3.65	3.65	0.42	0.42	<0.2	6.6
464554	1184944	SWRR2.5	90478136	10,400	10,400	2.6	2.6	0.47	0.47	<0.2	10.8
465250	1194216	SWRR2.5	90478137	8,570	8,570	2.53	2.53	0.28	0.28	<0.2	8.8
462524	1190452	SWRR2.3	90478138	8,460	8,460	6.12	6.12	0.29	0.29	<0.2	9.1
454159	1223043	CL10.3	91238155	40,700	43,800	2.9	2.9	1.64	1.335	0.97	0.535
		CLRG12.2	90478102	46,900		2.9		1.03		<0.2	27.5
											22
											50,000
											55,700

ALL VALUES = MG/KG

10-3

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

STN	LOC	SITE	NO.	Al	Ba	Be	Cd	Cr	Cu	Fe	Mn	Si	Sn					
454014	1224057	CL20.3	91238156	22,500	20,160	1.5	1.09	0.76	0.77	0.485	15.6	16.76	12.5	13.95	36,600	33,350		
		CLRG22.2	90478103	17,800		1.5	0.41		0.2		17.9		15.4		30,100			
454050	1224424	CL30.3	91238157	26,000	22,360	2.8	2.8	1.48	1.135	1.3	0.7	29.9	27.36	23.4	23.3	35,700	31,400	
		CLRG32.2	90478104	18,700			0.79		<0.2		24.8		23.2		27,100			
454653	1223558	CL40.3	91238158	35,900	37,860	5.54	5.64	1.3	1.02	0.91	0.605	16.6	18.05	26.7	29.2	37,400	35,700	
		CLRG42.2	90478105	39,800			0.74		<0.2		19.5		31.7		34,000			
454742	1224135	CL50.3	91238159	26,400	30,250	6.89	6.89	1.15	1	0.79	0.445	18.9	21.7	12.4	18.15	30,000	35,050	
		CLRG52.2	90478106	34,100			0.85		<0.2		24.5		23.9		40,100			
455548	1224243	CL60.3	91238160	11,300	26,900			0.42	0.305	0.21	0.185	6.25	4.425	21.3	17	13,900	41,650	
		CL62.2	91238161	42,500			0.19		<0.2		2.6		12.7		69,400			
455207	1224355	CL70.3	91238162	16,100	13,760	2.12	2.12	0.68	0.585	0.39	0.42	9.59	8.44	27.1	25.65	17,700	16,350	
		CL72.2	91238163	11,400			0.49		0.45		7.29		24.2		15,000			
453343	1221828	CL80.3A	91238169	16,500	19,364			3.796	0.87	1.03077	1.1	0.95538	21.4	23.1154	20.8	23.3385	24,900	26,123
		CL80.3B	91238170	14,900				0.77		0.68		19.7		17.3		22,600		
		CL80.3C	91238173	17,800				0.93		1.9		21.3		28.2		27,000		
		CL80.3D	91238175	19,700				0.98		1.9		22.6		30.9		28,400		
		CL80.3V	91238164	21,000		5.65		1.05		1.4		21.9		25		26,100		
		CL80.8V	91238166	15,700		2.82		0.87		0.68		18.4		15.2		21,600		
		CL81.4V	91258511	14,800		2.70		0.78		0.55		19.2		17.3		21,200		
		CL82.2A	91238170	21,100				1.17		0.86		25.8		24.3		27,500		
		CL82.2B	91238172	22,400				1.19		0.78		28.3		25.7		29,900		
		CL82.2C	91238174	19,600				1.06		0.87		23.6		25.1		26,800		
		CL82.2D	91238176	20,700				1.16		0.42		26		24.9		27,600		
		CL82.2V	91238167	24,900		4.56		1.32		0.63		26.1		26.4		28,800		
		CL83.0V	91238168	22,500		3.25		1.25		0.65		26.2		22.3		27,200		
455053	1223856	CL90.3	91258512	33,300	25,800	6.74	6.195	1.36	1.09	0.7	0.62	22.4	18.76	54	39.25	36,600	29,300	
		CL92.2	91258513	17,700		3.65		0.82		0.54		15.1		24.5		22,000		
455036	1223958	CL100.3	91238177	20,900	24,800			1.01	1.11	0.69	0.705	16	18.3	8.62	9.71	26,000	29,300	
		CL102.2	91238178	28,700				1.21		0.72		20.6		10.8		32,600		
454614	1223507	CL110.3	91238179	31,400	31,400	2.85	3.08	1.32	1.36	0.72	0.715	23	23.9667	13.1	14.2333	30,600	32,733	
		CL112.2	91238180	32,400		3.31		1.36		0.71		25.6		15.3		33,500		
		CL312.2.3SS	91258446	30,400				1.4		0.94		23.3		14.3		34,100		
454745	1223805	CL120.3	91238181	29,900	33,423	3.42	3.42	1.46	1.79	1.1	1.06	21.4	23.2667	13.7	25	30,300	42,200	

ALL VALUES = MG/KG

10-4

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

LAT	LON	SITE	NO.	Al		As		Ba		Cd		Cr		Cu		Fe	
		CL120.08V	91238193	35,800				2.34		1.2		20.2		45.3		56,500	
		CL122.2	91238182	34,600				1.57		0.88		28.2		16		39,800	
454717	1223827	CL130.3	91238183	16,000	24,400			0.95	1.45	0.51	0.805	17	24.9	8.89	12,735	19,900	37,450
		CL132.2	91238184	32,800				1.95		1.1		32.8		16.7		55,000	
453623	1222654	CL140.3	91238185	25,600	26,867	3.89	4.42	1.53	1.63667	0.6	0.83667	19.2	22.0667	22.9	30.9867	34,300	39,567
		CL280.3SS	91238209	25,400		4.95		1.57		1		21.1		56		39,200	
		CL142.2	91238186	29,600				1.81		0.91		25.9		14		45,200	
454222	1223140	CL150.3	91238187	53,500	43,000	2.64	2.995	1.9	1.74333	1.3	1.06	29	26.2333	22.2	20.7	48,800	45,633
		CL282.2SS	91238210	42,500		3.35		1.73		1.2		26		21.9		46,200	
		CL152.2	91238188	33,000				1.6		0.68		23.7		18		41,900	
454503	1223605	CL160.3	91238189	26,000	26,700			1.93	1.94	0.86	0.92	25.9	25.7	9.79	10,635	56,900	54,950
		CL162.2	91238190	27,400				1.95		0.98		25.5		11.6		53,000	
454552	1224208	CL170.3	91238191	28,800	30,300	3.16	3.67	1.48	1.475	0.82	0.74	19.9	20.95	11.7	11.95	31,300	33,250
		CL172.2	91238192	31,800		4.18		1.47		0.66		22		12.2		35,200	
453449	1221647	CL180.3	91258504	38,500	42,787	2.70	2.91333	1.44	1.48333	0.85	0.97	27.1	28.8333	16.6	17.5867	32,700	36,933
		CL182.2	91258505	45,100		3.14		1.52		1.1		30.5		18.2		37,500	
		CL282.2SS	91258510	44,700		2.90		1.49		0.96		28.9		17.9		37,600	
454854	1223018	CL190.08V	91238193	35,800	48,657		6.034	2.34	2.15571	1.2	1.29429	20.2	23.3714	45.3	51.7143	56,500	55,571
		CL190.3	91238197	49,100		5.56		1.93		1.1		20.7		44		40,400	
		CL190.3V	91238194	50,200				2.12		0.96		18.5		55.6		43,700	
		CL191.0V	91238212	51,000		4.09		2.45		1.4		24.8		54.8		59,000	
		CL191.6V	91238195	42,300		6.21		2.51		1.4		23.5		52.1		77,600	
		CL192.2	91238198	59,200		7.87		1.76		1.5		29.5		53.6		54,400	
		CL192.2V	91238196	53,000		6.44		1.98		1.5		26.4		56.6		57,400	
454442	1224133	CL200.3A	91238211	27,600	30,985	4.33	5.583	1.42	1.48385	1.1	0.93769	20.5	21.9154	12.3	15.8364	33,100	37,254
		CL200.3B	91258514	29,600		4.37		1.46		1.2		21.4		14.3		36,500	
		CL200.3C	91238201	26,200		4.50		1.29		1.1		18.4		13.6		31,300	
		CL200.3D	91238203	30,100		5.57		1.6		1.1		20.7		14.8		38,600	
		CL200.3V	91258500	28,800				1.49		0.66		20.3		13.8		32,400	
		CL200.8V	91258501	30,400				1.52		0.88		21		13.6		33,000	
		CL201.8A	91258518	33,000		6.29		1.56		1		23.5		14.1		41,600	
		CL201.8B	91258515	27,600		3.70		1.33		0.85		20.6		11.6		34,100	
		CL201.8C	91238202	30,900		5.51		1.46		0.93		22.1		15.8		38,100	
		CL201.8D	91258517	35,800		5.92		1.61		1.1		24.6		16		41,600	
		CL201.8V	91258502	19,000				0.9		0.57		12.7		8.86		21,200	
		CL203.0V	91258503	39,500		8.34		1.7		0.85		28.9		28.7		51,300	

ALL VALUES = MG/KG

10-5

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

LAT	LON	SITE	MG	Al	Ba	Cd	Cr	Cu	Hg	Pb	Se
			CL205.1V	91238199	44,300	7.30	1.95	0.85	30.2	28.4	51,500
455307	1223815	CL210.3	91238204	52,900	54,650	3.75	4.115	2.07	1.92	1.1	23.825
		CL212.2	91238205	69,800		4.48		2.09		1.5	28.7
453958	1223100	CL220.3	91258506	48,300	48,900	1.60	1.46	1.8	1.8	1.8	21.6
		CL222.2	91258507	47,200		1.30			1.72	1.72	21.6
453748	1223115	CL230.3	91258508	47,000	60,050	2.00	2.16	1.78	1.87	1.3	14.1
		CL232.2	91258509	53,100		2.30		1.96		1.3	15.2
454215	1223453	CL240.3		38,800	41,800		3.01	1.8	1.72333	1.3	16.6
		CL300.3SS	91258447	37,700				1.52		0.89	19.1
		CL242.2	91238206	48,900		3.01		1.85		1.2	17.8
454200	1223313	CL250.3	91238207	47,700	46,700	2.70	2.65	1.88	1.955	1.2	22
		CL252.2	91238208	43,700		2.60		2.03		1.2	24.4
453654	1222824	CL260.3	91258516	46,100	48,600	1.90	2	1.85	1.89	1.1	14.8
		CL262.2	91258519	50,900		2.10		2.13		1.1	18.1
		CL270.3RS	91258520	19,200	19,350	2.80	2.76	0.53	0.665	0.55	24.5
		CL272.2RS	91258521	19,500		2.70		0.58		0.41	24.4
472129	1220717	PSL1A0.5	87278100	20,500	20,500					19	19
472256	1220642	PSL2A0.5	87278101	32,800	32,800			0.7	0.7	<.8	24
472317	1220642	PSL3A0.1	87278104	25,900	21,820			0.6	0.63	<.8	22
		PSL3A0.5	87278105	22,800				0.6		<.8	19
		PSL5AO.5DUP	87278102	21,800				0.6		<.8	19
		PSL3A1.0	87278106	25,500				0.6		<.8	26
		PSL3A4.0	87278107	13,100				<.5		<.8	25
472407	1220657	PSL4A0.5	87278108	17,100	17,100			<.5	<.5	<.8	16
472410	1220657	PSL4B0.5	87278109	15,500	15,233			<.5	0.33333	<.8	21
		PSL6A0.5	87278111	15,700				0.5		<.8	26
		PSB8AO.5DUP	87278147	14,500				<.5		8	18
472220	1220800	PSB1A0.5	87278112	23,800	23,800			0.7	0.7	<.8	24
472308	1221004	PSB2A0.5	87278113	21,900	22,450			0.7	0.75	<.8	24
		PSB6AO.5DUP	87278145	23,000				0.8		<.8	22

ALL VALUES = MG/KG

10-6

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

ST	LON	SITE	NO.	Al	As	Ba	Cd	Cr	Cu	Fe							
472404	1220945	PSB3A0.1	87278114	16,500	14,975	<.6	0.35	<.8	18	22	14	12	15,000	16,300			
		PSB3A1.0	87278118	19,200		0.6	<.8	<.8	20	11	11	15,700					
		PSB3A3.0	87278123	13,900		<.5	<.8	<.8	25	11	11	15,000					
		PSB3A5.0	87278124	10,300		<.5	<.8	<.8	25	11	11	15,500					
472405	1220943	PSB3B0.1	87278128	13,200	13,675	<.5	0.3125	<.8	<.8	14	19	10	9	11,800	13,700		
		PSB3B1.0	87278129	18,000		0.5	<.8	<.8	21	7	7	15,500					
		PSB3B2.0	87278130	13,300		<.5	<.8	<.8	20	11	11	13,300					
		PSB3B4.0	87278131	10,200		<.5	<.8	<.8	21	8	8	14,200					
472406	1220941	PSB3C0.1	87278132	10,900	12,175	<.5	<.5	<.8	<.8	14	20	14	14	11,900	12,950		
		PSB3C2.0	87278133	14,900		<.5	<.8	<.8	23	9	9	13,900					
		PSB3C4.0	87278134	12,700		<.5	<.8	<.8	25	22	22	13,300					
		PSB3C5.0	87278135	10,200		<.5	<.8	<.8	19	10	10	12,700					
472405	1220942	PSB3D1.0	87278136	16,900	16,900	<.5	<.5	<.8	<.8	22	22	10	10	14,900	14,900		
472404	1220944	PSB3E1.0	87278139	21,700	21,700	<.6	<.6	<.8	<.8	20	20	12	12	16,800	16,800		
472508	1220914	PSB4A0.1	87278140	14,900	19,160	<.5	0.37	<.8	0.4	25	24	14	11	14,000	12,320		
		PSB4A0.5	87278141	15,000		<.5	<.8	<.8	26	12	12	14,000					
		PSB4A2.0	87278142	28,300		0.6	<.8	<.8	24	8	8	11,300					
		PSB7A2.0DUP	87278146	25,000		0.5	<.8	<.8	20	8	8	10,300					
		PSB4A4.0	87278143	12,600		<.5	<.8	<.8	27	12	12	12,000					
472653	1221116	PSB5A0.5	87278144	7,390	7,390	<0.5	<0.5	<0.8	<0.8	12	12	4	4	5,920	5,920		
472143	1220734	PSSED1A	87278148	13,200	13,200	<.5	<.5	5	5	19	19	14	14	17,900	17,900		
472129	1220742	PSSED1B	87278149	11,800	11,800	<.5	<.5	<.8	<.8	20	19.5	24	18	14,800	16,350		
		PSSED1C	87278150	11,400		<.5	<.8	<.8	<.8	19	12	12	17,900				
472131	1220725	PSSED2A	87278151	13,300	12,850	<.5	<.5	2	1.2	28	21.5	24	21	17,300	17,100		
		PSSED2B	87278152	12,400		<.5	<.8	<.8	<.8	15	18	18	16,900				
472112	1220742	PSSED3A	87278153	12,600	14,150	<.5	0.375	<.8	0.7	23	22.5	18	25	18,100	19,450		
		PSSED3B	87278154	15,700		0.5	1	1	22	32	32	32	20,800				
483845	1225008	PS10.3	93088519	24,000	20,800	6.64	5.818	0.71	0.644	0.55	0.424	34.1	35.3	32.1	29.24	28,700	29,040
		PS300.3DUP	93088637	21,000		5.72	0.66	<0.2			31.2		28.8		27,400		
		PS12.2	93088520	21,700		6.29	0.42	0.55			36.3		29.8		27,300		
		PS302.2DUP	93088638	16,700		5.99	0.44	<0.2			33.4		25.4		25,500		
		PS155	93088521	20,600		4.45	0.49	0.82			41.5		30.1		36,300		

ALL VALUES = MG/KG

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

LAT	LON	SITE	NO.	Al		As	Ba	Cd	Cu	Cr	Fe	
483355	1225604	PS20.3	93088522	14,600	14,176	2.79	3.735	0.37	0.37	19.6	22,625	15.5
		PS270.3DUP	93088631	13,400		2.3	0.36	<0.2		17.9	15	15,800
		PS22.2	93088523	17,300		6	0.38	0.55		30.8	15.5	28,200
		PS272.2DUP	93088632	11,400		3.85	0.23	<0.2		22.2	10.3	20,400
485910	1223507	PS30.3	93088524	22,900	20,067	4.58	4.25	0.38	0.36667	0.78	0.56667	29.2
		PS32.2	93088525	22,700		4.48	0.39	0.62		38.6	16.6	23,100
		PS355	93088526	14,600		3.69	0.33	0.3		26.1	11.4	18,700
481630	1214308	PS40.3V	93088527	20,600	21,936	9.07	9.39788	0.28	0.32	1.1	0.83143	47.8
		PS320.3SS	93088641	19,700		10.2	0.27	0.26		45.1		38.8
		PS41.0V	93088528	21,100		8.3	0.32	0.59		46.2		33,400
		PS42.2V	93088529	20,300		7.56	0.3	1.4		44.6		37,400
		PS43.0V	93088530	21,100		7.91	0.33	0.67		47.6		32,100
		PS44.9V	93088531	26,200		14.1	0.37	1.1		59.2		36,500
		PS40.3A	93088532	21,500		10.5	0.33	0.92		47.7		47,400
		PS40.3B	93088533	23,000		9.43	0.33	1		50.6		36,600
		PS40.3C	93088534	19,800		8.66	0.28	1		42.8		38,100
		PS40.3D	93088535	18,200		8.16	0.27	0.77		40.8		35,500
		PS42.2A	93088536	22,300		8.35	0.34	0.65		50.1		35,200
		PS42.2B	93088537	25,700		10.8	0.36	0.8		59		42,600
		PS42.2C	93088538	25,000		8.77	0.38	0.67		54.2		40,900
		PS42.2D	93088539	22,600		9.76	0.32	0.71		52		38,400
480938	1224043	PS50.3	93088540	12,000	12,400	2.32	2.215	0.22	0.23	0.37	0.38	21.4
		PS51.5	93088541	12,800		2.11	0.24		0.39		22.6	12.7
480239	1231923	PS60.3	93088542	10,000	10,713	1.18	1.61667	0.24	0.25333	0.28	0.30333	14
		PS62.2	93088543	12,600		1.11	0.29		0.3		15.5	16.3667
		PS655	93088544	9,540		2.56	0.23		0.33		19.6	6.78
471643	1220203	PS70.3V	93088545	13,300	11,680	5.57	4.27429	0.38	0.29143	0.47	0.36571	22.6
		PS71.4V	93088546	15,600		5.82	0.39	0.55		14.4		20.7
		PS72.2V	93088547	8,660		2.56	0.24	0.26		16.1		25,300
		PS73.0V	93088548	16,300		6.51	0.39	0.49		14.2		12,500
		PS73.8V	93088549	16,000		5.68	0.38	0.58		15.9		27,600
		PS70.3A	93088550	10,500		3.93	0.19	0.57		20.2		24,900
		PS70.3B	93088551	10,600		3.84	0.26	0.41		17.1		15,900
		PS70.3C	93088552	10,400		4.44	0.28	0.21		18.9		15,300
		PS310.3SS	93088639	10,300		4.54	0.25	<0.2		20.3		16,400
		PS70.3D	93088553	8,860		3.75	0.23	0.27		20		13,200
		PS72.2A	93088554	10,900		3.3	0.27	0.34		23.1		16,600
		PS72.2B	93088555	10,100		2.77	0.27	0.29		18.3		15,300

ALL VALUES = MG/KG

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

LAT	LON	SITE	NO.	Al	As	Ba	Cd	Cr	Cu	Fe	Mn	
475035	1214917	PS72.2C	93088556	11,700	4.06	0.3	0.48	22.2	16.1	17,500		
		PS72.2D	93088557	10,300	3.07	0.25	<0.2	19.1	13.9	16,000		
474226	1225456	PS80.3	93088558	18,000	21,400	11.3	8.615	0.26	0.28	38.9	41.95	
		PS82.2	93088559	24,800	5.93	0.4	<0.2	45	20.4	24,600	25,850	
475420	1225412	PS90.3	93088560	28,300	32,300	1.81	1.665	0.44	0.47	<0.2	43.9	
		PS91	93088561	36,300	1.52	0.5	<0.2	53.6	48.75	49.7	64.55	
471843	1223157	PS100.3	93088562	13,300	13,850	3.74	2.99	0.23	0.23	<0.2	21.3	
		PS102.2	93088563	14,400	2.24	0.23	<0.2	21	8.03	7.59	12,900	
472827		PS110.3V	93088564	14,800	16,540	11.2	17.1685	0.27	0.26615	0.21	19.1	
		PS111.4V	93088565	18,600	11.6	0.32	0.33	25	20.6	32.0308	10,900	
		PS112.2V	93088566	20,500	2.46	0.29	<0.2	29.6	18.9	13,354	16,600	
		PS113.0V	93088567	23,000	9.34	0.29	0.44	30.7	22	18,000		
		PS114.0V	93088568	14,700	5.04	0.26	<0.2	22	16.7	11,700		
		PS110.3A	93088569	8,820	73.3	0.14	2.6	11.8	111	7,400		
		PS110.3B	93088570	17,600	19.3	0.31	0.37	25	23	16,100		
		PS110.3C	93088571	14,400	50.7	0.22	0.82	29.4	101	11,400		
		PS110.3D	93088572	14,000	23.5	0.23	0.59	19	34.7	10,700		
		PS112.2A	93088573	16,800	3.94	0.27	<0.2	23.2	12.6	12,000		
		PS112.2B	93088574	14,600	3.75	0.22	<0.2	21.7	11.1	12,400		
		PS112.2C	93088575	20,400	6.04	0.33	<0.2	29.8	19.1	15,900		
		PS112.2D	93088576	16,800	3.02	0.31	<0.2	30.3	11.8	16,700		
471723	1232215	PS120.3	93088577	15,800	16,367	2.52	1.99333	0.27	0.27	<0.2	16.2	
		PS122.2	93088578	18,800	1.66	0.27	<0.2	24	10.7	16,200		
		PS292.2SS	93088636	14,500	1.8	0.26	<0.2	24.9	9.06	13,000		
472232	1225818	PS130.3	93088579	82,100	84,900	2.2	2.35	0.86	0.875	<0.2	45.3	
		PS132.2	93088580	87,700	2.5	0.89	0.28	49.2	231	243.5	109,000	
		PS140.3	93088581	19,900	17,900	2.5	1.8	0.29	0.26667	<0.2	23.4	
465504	1225420	PS141.5	93088582	21,300	1.5	0.26	<0.2	26.7	28.2	16.5	19,1687	
		PS1455	93088583	12,500	1.4	0.22	<0.2	34.5	20.4	18,800	18,200	
		PS150.3V	93088584	25,500	23,193	3.36	3.81929	0.48	0.41	<0.2	18.2	
465504		PS151.2V	93088585	26,900	2.8	0.46	<0.2	17.7	19.5	18,300		
		PS152.2V	93088586	24,400	2.7	0.43	<0.2	19.5	18.7	18,000		
		PS153.0V	93088587	21,300	2.5	0.34	<0.2	18.2	18.8	18,000		
		PS154.3V	93088588	17,300	2.5	0.3	<0.2	15.9	18.6	18,000		
		PS312.2SS	93088640	18,400	2.3	0.4	<0.2	18	17.8	18,200		
		PS150.3A	93088589	24,100	3.18	0.39	<0.2	18.1	17.1	17,900		

ALL VALUES = MG/KG

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

LAT	LONG	SITE	NG	Al	As		Cd		Cr		Cu		Fe				
					ppm	%	ppm	%	ppm	%	ppm	%	ppm	%			
46.5500	-122.1853	PS150.3B	93088590	24,500	4.27	0.43	<0.2		17	16.4	16,900		16,900				
		PS150.3C	93088591	23,900	4.28	0.43	<0.2		17.2	16.3	17,200		17,200				
		PS150.3D	93088592	23,700	3.7	0.46	<0.2		16	17.6	18,000		18,000				
		PS152.2A	93088593	22,800	2.1	0.37	<0.2		20.1	17.7	17,400		17,400				
		PS152.2B	93088594	22,200	8.75	0.39	<0.2		19.1	19.7	17,200		17,200				
		PS152.2C	93088595	23,300	8.63	0.41	<0.2		22.1	17.6	17,300		17,300				
		PS152.2D	93088596	26,400	2.4	0.45	<0.2		19	19.9	19,000		19,000				
48.0812	122.1653	PS160.3	93088597	16,000	17.480	2.3	0.25	0.27	<0.2	18	22.6	10.2	11.85	15,200			
		PS161.2	93088598	18,900		2.3	0.29	<0.2		27.2		13.5		15,900			
47.1307	122.2000	PS170.3	93088599	10,900	10.360	3.25	2.636	0.33	0.306	<0.2	14.6	14.28	37.9	29.65	13,700		
		PS172.2	93088600	9,820		1.82	0.28	<0.2		13.9		21.4		13,200			
47.1055	124.1132	PS180.3	93088601	17,900	20.675	2.84	2.86	0.28	0.3225	<0.2	43.2	33.225	25	25.3	39,300		
		PS182.2	93088602	27,000		3.04	0.39	<0.2		45.2		40.5		45,700			
		PS282.2SS	93088634	23,400		3.89	0.25	<0.2		22.8		13.7		27,800			
		PS1855	93088603	14,400		1.67	0.37	<0.2		21.7		22		25,200			
47.4657	124.1729	PS190.3	93088604	18,800	20.125	2.54	2.935	0.13	0.298667	<0.2	<0.2	17	21.225	8.43	14.6825	24,400	
		PS192.2	93088605	23,900		3.64	0.42	<0.2		23.4		14.6		29,300			
		PS1955	93088606	15,200		2.01	0.34	<0.2		16.2		9.64		24,900			
47.3919	122.2451	PS200.3V	93088607	12,000	12.462	6.29	4.326	0.23	0.24333	<0.2	0.14	16.4	19.92	10.2	10.8493	10,700	
		PS200.8V	93088608	13,500		2.14	0.26	<0.2		16.7		6.86		11,300			
		PS202.2V	93088609	11,500		1	0.23	<0.2		16.9		8.13		10,200			
		PS203.0V	93088610	9,310		1.4	0.19	<0.2		18.3		8.46		10,700			
		PS204.5V	93088611	9,620		1.51	0.24	<0.2		20.1		8.98		11,700			
		PS200.3A	93088612	12,900		13.5	0.27	0.34		24.1		16		12,300			
		PS290.3SS	93088635	13,300		6.38	0.27	0.32		19.3		15.2		11,400			
		PS200.3B	93088613	13,100		10.5	0.25	0.24		20		14.5		11,200			
		PS200.3C	93088614	14,500		7.9	0.29	<0.2		18.3		12.6		11,200			
		PS200.3D	93088615	11,500		4.02	0.23	<0.2		20.1		10.4		10,800			
		PS202.2A	93088616	15,700		2.06	0.29	<0.2		27.4		9.45		13,800			
		PS280.3SS	93088633	11,100		3.11	0.21	<0.2		22.4		15.1		16,000			
		PS202.2B	93088617	13,300		1.58	0.24	<0.2		21		8.88		11,500			
		PS202.2C	93088618	12,600		1.4	0.21	<0.2		20.4		8.98		11,900			
		PS202.2D	93088619	13,000		2.1	0.24	<0.2		17.4		9		10,800			
47.0353	122.1824	PS210.3	93088620	25,500	31.800	4.46	2.83	0.57	0.7	<0.2	9.97	16.385	11.7	20.3	16,000	20,500	
		PSWRF2.7	90478097	38,100		1.2	0.83	<0.2		22.8		28.9		25,000			
46.5501	122.3333	PS220.3	93088621	28,700	34.450	2.3	2.145	0.59	0.665	<0.2	<0.2	10	17.55	16.4	20.65	13,300	17,650
		PSWRF2.5	90478098	40,200		1.99	0.74	<0.2		25.1		24.9		22,000			

ALL VALUES = MG/KG

10-10

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

ID#	LOCN	SITE	NO.	Al	As	Ba	Cd	Cr	Cu	Ge	Fe	Pb
465728	1223904	PS230.3	93088622	16,200	22,400	2	1.975	0.36	0.415	<0.2	13.3	19.95
		PSWRF2.5	90478099	28,600		1.95	0.47	<0.2		26.6	18.3	21,400
475451	1221040	PS240.3	93088623	20,000	24,800	6.29	5.585	0.45	0.63	0.21	0.165	35.8
		PSWRF2.5	90478100	29,600		4.88	0.61	<0.2		59.7	47.75	18.7
482413	1221025	PS250.3	93088624	13,500	18,750	4.26	4.215	0.15	0.185	<0.2	157	235
		PSWRF2.7	90478101	24,000		4.17	0.22	<0.2		313	13.1	26.5
464743	1221631	PSLB10.3	93088625	14,400	13,700	2	2.15	0.37	0.395	<0.2	15.4	17.95
		PSLB12.2	93088626	13,000		2.3	0.42	<0.2		20.5	21.1	17.6
472742	1221326	PSLB20.3	93088627	33,000	38,300	1.1	1.45	0.54	0.61	<0.2	63.2	79.05
		PSLB22.2	93088628	45,600		1.8	0.68	<0.2		94.9	71.3	86.65
460223	1184019	PS260.3RS	93088629	9,330	8,970	3.79	3.57	0.43	0.435	<0.2	9.35	9.11
		PS262.2RS	93088630	8,610		3.35	0.44	<0.2		8.87	16.5	16.2
472457	1184356	SB10.3	92268500	9,070	8,934	3.59	4.0275	0.36	0.3775	0.51	0.465	6.5675
		SB330.3SS	92268574	9,570		3.15	0.38	<0.2		7.45	14	14.4
		SB12.2	92268501	7,940		5.22	0.35	<0.2		5.73	13.1	16,500
		SB320.3SS	92268573	9,155		4.15	0.42	<0.2		6.22	15.1	19,400
473910	1180946	SB20.3	92268502	15,800	15,700	3.92	5.11333	0.61	0.66333	0.46	0.45333	7.47
		SB340.3SS	92268575	17,100		3.72	0.66	<0.2		7.79	8.95333	14.9
		SB22.2	92268503	14,200		7.70	0.72	<0.2		11.6	14.4	15,400
475026	1175046	SB30.3	92268504	13,500	14,675	6.17	7.9475	0.64	0.6675	0.55	0.54	7.48
		SB32.2	92268505	14,500		9.87	0.68	<0.2		9.93	9.235	12.8
		SB270.3 SS	92268568	17,600		9.92	0.73	<0.2		11	14.1	22,900
		SB3SSBD	92268506	13,100		5.83	0.62	<0.2		8.53	14.8	24,500
470819	1174318	SB40.3	92268507	13,000	12,850	2.55	2.515	0.52	0.535	0.51	0.645	12.9
		SB41.2	92268508	12,700		2.48	0.55	<0.2		13.2	13.05	15.2
474232	1173037	SB50.3	92268509	13,300	13,650	3.82	4.305	0.64	0.655	0.76	0.685	9.87
		SB51.3	92268510	14,000		4.79	0.67	<0.2		11.2	10.535	12.1
480033	1172325	SB60.3	92268511	12,200	10,623	3.21	3.485	0.54	0.605	0.47	0.3125	10.9
		SB290.3SS	92268570	14,500		3.03	0.62	<0.2		11.2	7.32	8.15
		SB62.2	92268512	9,680		3.90	0.48	<0.2		12.1	8.89	14,300
		SB6SS	92268513	6,110		3.80	0.38	<0.2		12.2	5.3	13,400
												9,170

ALL VALUES = MG/KG

10-11

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

LAT	LON	SITE	NO.	Al	Mg	Ca	Si	Ti	Cr	Co	Ni	Fe					
481824	1173603	SB70.3	92268514	30,100	20,637	2.10	1.13667	0.95	0.72333	1	0.85333	10.5	10.9767	30.2	29.0333	22,700	24,100
		SB71.8	92268515	22,100		0.71		0.88		0.73		14.8		38.6		35,600	
		SB7SS	92268516	9,410		0.60		0.34		0.23		7.63		18.3		14,000	
475949	1181738	SB80.3	92268517	15,500	15,067	5.82	6.45333	0.62	0.58667	0.82	0.87667	11.2	12.0333	11.6	11.4667	13,400	13,967
		SB310.3SS	92268572	16,000		5.90		0.56		0.79		10.7		11.8		13,400	
		SB82.2	92268518	13,700		7.64		0.58		0.42		14.2		11		15,100	
485517	1173112	SB90.3	92268519	14,300	12,803	3.10	2.74	0.55	0.47667	0.7	0.62667	11.8	11.0533	15.9	14.1433	20,500	18,400
		SB91.4	92268520	15,300		3.32		0.55		0.69		13.4		17.2		20,300	
		SB9SBD	92268521	8,210		1.80		0.33		0.49		7.96		9.33		14,400	
480433	1171952	SB100.3	92268522	26,600	25,850	5.74	6.41	0.84	0.825	0.61	0.535	11.3	11.85	13.9	13.5	16,500	17,000
		SB102.2	92268523	25,100		7.08		0.81		0.46		12.4		13.1		17,500	
474434	1175413	SB110.3	92268524	19,100	18,975	5.92	6.9275	0.72	0.8825	0.66	0.57	14.8	13.025	34.2	26.725	23,000	25,300
		SB111.3	92268525	18,800		7.95		0.74		0.57		13.1		18.8		37,800	
		SB350.3SS	92268576	15,900		8.27		0.7		0.65		13.1		35.6		20,200	
		SB11SBD	92268526	14,100		5.57		0.57		0.4		11.1		14.3		20,200	
474018	1174407	SB120.3	92268527	18,700	19,950	3.05	3.645	0.73	0.785	0.45	0.41	14.7	16.95	16.8	17.3	17,900	19,500
		SB122.2	92268528	21,200		4.24		0.84		0.37		19.2		17.8		21,100	
471929	1170403	SB130.3	92268529	24,200	21,275	3.46	3.45	0.88	0.82	0.62	0.4625	19.2	18.775	17.2	16.3	22,300	21,225
		SB300.3SS	92268571	23,900		2.30		0.88		0.41		18.3		16.8		21,800	
		SB132.2	92268530	20,400		4.35		0.85		0.36		22.9		18.1		23,900	
		SB13SBD	92268531	16,600		3.69		0.67		0.46		14.7		13.1		16,900	
472534	1171355	SB140.3	92268532	16,500	15,363	2.10	2.3	0.63	0.62625	0.25	0.34	14	12.3375	14.4	15.8625	16,000	14,663
		SB142.2	92268533	19,900		2.60		0.71		0.36		13.7		17.4		17,600	
		SB140.3V	92268534	17,000		1.70		0.62		0.36		13.6		14.4		15,800	
		SB140.8V	92268535	14,800		2.80		0.66		0.41		12.4		15		15,300	
		SB142.2V	92268536	13,800		2.30		0.62		0.29		10.9		16.5		13,100	
		SB280.3SS	92268569	14,800		2.40		0.66		0.4		11.4		16.8		14,200	
		SB143.7V	92268537	13,300		2.40		0.56		0.34		11.2		16.9		12,900	
		SB145.0V	92268538	12,800		2.10		0.55		0.31		11.5		15.5		12,400	
470433	1171952	SB150.3	92268539	15,500	14,850	2.70	3.3	0.74	0.75	0.33	0.38	14.5	16	13.5	13.35	16,300	17,050
		SB152.2	92268540	13,600		3.90		0.76		0.39		17.5		13.2		17,800	
472343	1172004	SB160.3	92268541	21,200	23,650	2.70	2.75	0.78	0.875	0.29	0.395	20.2	20.25	17.7	18.25	23,300	24,750
		SB162.2	92268542	26,100		2.80		0.97		0.5		20.3		18.8		26,200	
474257	1174500	SB170.3	92268543	17,100	16,500	6.66	8.63	0.65	0.67	0.39	0.37	12.2	12.7	17.8	17.3	20,200	21,100

ALL VALUES = MG/KG

10-12

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

LAT	LON	SITE	NO.	Al	As	Ba	Cd	Cr	Cu	Fe	
		SB172.2	92268544	15,900		10.40	0.69	0.35			22,000
474346	1170832	SB180.3	92268545	20,100	17,000	6.57	0.635	0.64	0.605	0.41	13.2
		SB182.2	92268546	13,900		10.70	0.57	0.39			17,000
475233	1173614	SB190.3V	92268547	16,900	13,235	8.16	0.3257	0.68	0.63643	0.3	0.33867
		SB191.2V	92268548	15,700		10.30	0.67	0.51			11.8
		SB192.2V	92268549	11,500		11.90	0.57	0.42			12.5
		SB193.6V	92268550	11,700		16.60	0.81	0.34			13
		SB194.4V	92268551	13,200		14.20	0.63	0.44			14.6
		SB190.3A	92268552	16,700		6.89	0.68	0.37			13.5
		SB192.2A	92268553	18,400		9.02	0.74	0.83			12.4
		SB190.3B	92268554	14,600		7.89	0.69	<0.3			11
		SB192.2B	92268555	7,880		10.10	0.5	<0.3			13.5
		SB190.3C	92268556	14,400		8.16	0.71	<0.3			12.9
		SB192.2C	92268557	12,400		18.20	0.66	0.32			13.6
		SB190.3D	92268558	13,900		7.07	0.66	0.46			17.2
		SB192.2D	92268559	8,990		12.40	0.51	<0.3			10.3
		SB19.SS	92268560	9,020		3.67	0.6	<0.3			10.6
											12.1
474232	1171937	SB200.3	92268561	17,100	19,450	2.70	2.55	0.79	0.82	0.3	0.375
		SB202.2	92268562	21,800		2.40	0.85	0.45			7.62
473743	1171000	SB210.3	92268563	11,900	12,650	6.62	0.01	0.58	0.54	0.33	0.215
		SBRU2.3	90478140	13,400		9.4	0.5	<0.2			10.9
474313	1173053	SB220.3	92268564	19,100	19,850	4.72	6.26	0.83	0.72	0.33	0.215
		SBRU2.5	90478141	20,600		5.8	0.61	<0.2			12.7
475037	1175147	SB230.3	92268565	12,000	14,150	4.29	4.995	0.62	0.65	0.3	0.2
		SBRU2.8	90478142	16,300		5.7	0.48	<0.2			10.8
475002	1175805	SB240.3	92268566	10,800	12,050	8.04	8.42	0.51	0.495	<0.3	0.125
		SBRU2.6	90478143	13,300		8.8	0.48	<0.2			16.1
475232	1180911	SB250.3	92268567	10,800	12,500	5.55	6.55	0.51	0.515	<0.3	0.125
		SBRU2.6	90478144	14,200			0.52	<0.2			10.6
475453	1172838	SB380.3	92268577	17,400	15,000	4.75	6.415	0.62	0.58	0.27	0.185
		SB382.2	92268578	12,600		6.08	0.54	<0.2			10.9
475349	1171054	SB390.3	92268579	14,400	13,100	1.40	1.46	0.94	0.89	0.26	0.18
		SB391.5	92268580	11,800		1.50	0.84	<0.2			4.5
											4.5
											3.9
											-4.19
											10,300
											9,670
											9,040

ALL VALUES = MG/KG

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

LAT	LON	SITE	NO.	Al	As	Ba	Be	Cd	Cr	Co	Fe	Mn	Pb	Ti
463437	1205022	YB10.3	91258554	13,500	13,500	0.9	0.88	1.15	1.15	0.46	0.46	13.3	13.3	13,300
463222	1202650	YB20.3	91258556	15,300	15,300	2.5	2.5	0.82	0.82	0.61	0.61	15	15	19,600
463153	1203223	YB30.3	91258558	19,700	19,700	1.8	1.8	0.95	0.95	0.72	0.72	14.3	14.3	17,700
462623	1195653	YB40.3	91258559	19,000	19,300	2.6	2.995	0.88	0.905	0.23	0.405	17	18.5	17.9
		YB42.2	91258560	19,600		3.4		0.93		0.58		20		18.75
461355	1192417	YB50.3A	91258566	13,600	14,886	5.1	7.62571	0.84	0.92071	0.71	0.62329	12	13.1671	18.2
		YB50.3B	91258568	12,500		3.5		0.77		0.52		11.4		12.9
		YB50.3C	91258537	15,800		9.1		0.93		0.44		11.5		20.7
		YB50.3D	91258539	15,200		6.5		0.91		0.45		12.2		20.7
		YB50.3V	91258574	14,200		4.6		0.82		0.44		12.7		18.4
		YB340.3SS	91258582	13,700		4.4		0.81		0.76		13.1		25,400
		YB50.7V	91258575	16,100		5.1		0.89		0.58		13.4		19.9
		YB51.3V	91258576	17,100		7.8		0.98		0.75		16.1		29,800
		YB52.2A	91258567	15,700		10.9		1.05		1.1		13.3		21
		YB52.2B	91258564	13,400		5.4		0.84		0.67		14.2		34,300
		YB52.2C	91258538	14,100		11.5		1.07		0.52		12.3		34,000
		YB52.2D	91258540	14,000		9.9		1.03		0.73		11.6		32,600
		YB52.2V	91258577	16,000		11.2		0.94		0.57		13.9		27,600
		YB53.2V	91258565	17,000		11.6		1.01		0.57		16.5		31,200
461445	1200151	YB60.3	91258562	23,000	27,800	5.4	4.82	1.05	1.15667	0.49	0.66	29.3	31.6	23
		YB332.2SS	91258569	26,000		5.4		1.09		0.58		31.8		37,400
		YB62.2	91258563	34,400		3.7		1.33		0.91		33.7		45,800
460709	1204921	YB70.3	91258421	47,100	56,650			2.25	2.79	0.95	1.275	6.54	7.67	20.8
		YB72.2	91258422	66,000				3.33		1.6		8.8		64,800
460959	1203706	YB80.3	91258423	23,000	26,667			1.13	1.31	0.85	0.67667	14.9	18.6333	17.9
		YB362.2	91258429	23,100				1.13		0.58		16		29,100
		YB81.8	91258424	33,900				1.67		0.6		25		42,800
461920	1202619	YB90.3A	91258571	20,900	21,914	2.4	2.43	1.04	1.04429	0.62	0.66571	10.7	12.0029	21
		YB90.3B	91258573	23,100		1.4		1.22		0.57		12.4		34,000
		YB90.3C	91258578	23,700		1.7		1.26		0.8		12.6		34,900
		YB342.2SS	91258583	23,500		1.8		1.26		1.4		11.2		34,900
		YB90.3D	91258581	24,700		2.2		1.2		0.94		12		36,900
		YB90.3V	91258417	18,800				0.95		0.35		9.98		27,600
		YB90.7V	91258418	12,400				0.58		0.6		3.6		14,900
		YB92.2A	91258572	27,200		3.2		1.18		0.8		16		36,500
		YB92.2B	91258580	18,000		3.4		0.76		0.5		8.5		20,900

ALL VALUES = MG/KG

10-14

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

LAT	LON	SITE	NG	Al	As	Ba	Cd	Cr	Cu	Fe
462827	1202727	YB92.2C	91258579	23,900	2.4	0.97	0.49	12.9	17	31,100
		YB92.2D	91258541	20,500	2.9	0.94	0.43	9.46	15.5	27,800
		YB92.2V	91258419	21,100		0.9	<0.2	11	16.3	26,100
		YB93.5V	91258420	26,600		1.18	1	18.4	31.5	36,200
		YB95.0V	91258570	22,400		1.18	0.72	19.3	24.3	40,600
464415	1203715	YB100.3	91258542	20,200	21,950	3.1	3.475	0.96	1.085	0.46
		YB102.2	91258543	23,700		3.9	1.21		0.8	
		YB110.3	91258544	21,000	23,000	1.5	1.6	0.69	0.78	0.37
471215	1205848	YB360.3SS	91258412	24,200				0.48333	11.4	11.7333
		YB112.2	91258411	23,800				11.5		17.2
		YB12.2	91258555	17,100	32,579	0.6	3.868	1.4	1.07571	0.56
		YB120.3A	91258430	31,600		4.1	0.96		0.60071	14
		YB120.3B	91258432	29,400		4.1	0.9	0.43		36.9
		YB120.3C	91258413	25,400		3.6	0.78	0.44		18.1
		YB120.3D	91258415	31,600		4.5	0.95	0.42		21,900
		YB120.3V	91258425	33,600			1.09	0.55		15.8
		YB120.7V	91258426	35,900			1.15	0.72		18,800
		YB121.0V	91258427	40,300			1.23	0.83		22,800
		YB122.2A	91258431	34,800		4.6	1.06	0.3		22,300
		YB122.2B	91258433	32,600		4.0	1.01	0.46		25,700
		YB122.2C	91258414	34,300		4.4	1.06	<0.2		28,100
471015	1205856	YB122.2D	91258416	36,100		4.6	1.12	0.68		26,100
		YB122.2V	91258428	40,400			1.31	0.74		28,000
		YB123.2V	91258526	33,000		4.1	1.04	0.56		28,500
		YB130.3	91258404	28,100	29,600	2.9	0.98	1.03667	0.77	104
		YB360.3SS	91258408	26,100		2.9	0.89	0.86		22.6
470505	1202520	YB132.2	91258405	34,600			1.24	0.77		37,200
		YB140.2	91258524	24,400	20,750	1.3	1.34286	1.2	1.4175	0.59
		YB140.2V	91258545	20,800		1.7	1.46		1.3	17.1625
		YB140.6V	91258546	18,400		1.5	1.38	0.72		35,100
		YB330.3SS	91258551	18,400		1.3	1.42	0.97		40,500
		YB141.0	91258523	25,400			1.52	0.72		38,000
		YB141.0V	91258547	20,300		1.3	1.38	0.81		35,900
		YB141.7V	91258548	20,400		1.2	1.59	0.85		42,300
465850	1204027	YB142.5V	91258525	17,900		1.1	1.39	0.78		39,800
		YB150.3	91258549	25,100	27,200	1.9	1.8	1.21	1.245	0.64
		YB151.6	91258550	29,300		1.7	1.28		1.1	14.8

ALL VALUES = MG/KG

10-15

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

STN	LOC	SITE	NO.	Al	As	Ba	Cd	Cu	Cr	Fe	Mn
471047	1204419	YB160.3	91258406	24,200	23,233	3.12	2.5	0.98	0.98	0.51	0.4
		YB352.2SS	91258409	19,800		2.1		0.88	<0.2		27.8
		YB162.2	91258407	25,700		2.9		1.08		0.59	34.2
471407	1204807	YB170.3	91258552	14,800	18,450	2.5	2.815	0.72	0.72	0.58	0.515
		YB172.1	91258553	18,100		3.1		0.72		0.45	41.4
463713	1211038	YB180.3	91258528	19,600	20,850	2.0	2.3	0.69	0.77	0.49	0.525
		YB182.2	91258527	22,100		2.6		0.85		0.56	15
462441	1205344	YB190.3	91258403	34,600	41,400		1.83333	1.49	1.97	1.12	1.32857
		YB190.3V	91258529	37,900		1.4		1.59		1.2	14
		YB190.7V	91258530	39,600		1.8		1.84		1	15.9
		YB191.2V	91258400	43,700		1.8		2.27		1.6	22.2
		YB192.2	91258410	38,000		1.7		1.8		0.98	18.2
		YB192.2V	91258401	50,500		2.2		2.49		1.9	23.1
		YB194.0V	91258402	45,500		2.1		2.31		1.5	20.8
470048	1210530	YB200.3	91258533	10,900	10,650	2.1	1.95	0.45	0.39	0.36	0.35
		YB201.0	91258534	10,400		1.8		0.33		0.34	2.41
472528	1203915	YB210.3	91258535	23,400	24,550	38.1	28.6	0.79	0.83	0.5	0.666
		YB210.8	91258536	25,700		19.1		0.87		0.83	128
472417	1212868	YB22.2	91258557	17,600	20,133	2.6	2.91667	0.94	0.7	0.36	0.37
		YB220.3	91258531	15,700		3.8		0.47		0.34	6.88
		YB222.0	91258532	27,100		2.3		0.69		0.41	10.9
461432	1191954	YB230.3	91258439	12,400	11,700	3.6	3.685	0.77	0.86	0.27	0.185
		YBRO2.5	90478123	11,000		3.8		0.53		<0.2	11.4
461727	1194425	YB240.3	91258440	15,500	14,600	5.2	5.33	0.89	0.73	0.45	0.275
		YBRO2.5	90478124	13,700		5.5		0.57		<0.2	17
462522	1204526	YB250.3	91258441	19,100	18,900	2.5	3.05	0.99	0.805	0.54	0.32
		YBRO2.5	90478125	14,700		3.6		0.62		<0.2	15.8
461843	1202937	YB260.3	91258442	18,800	15,450	4.4	4.695	1.11	0.89	0.56	0.33
		YBRO2.3	90478126	12,100		5		0.67		<0.2	15.7
464114	1203916	YB270.3	91258443	19,200	15,600	3.5	3.365	0.86	0.635	0.63	0.365
		YBRO2.2	90478127	12,000		3.2		0.41		<0.2	16.4
470433	1202247	YB280.3	91258435	22,200	25,300	1.0	0.96	1.36	1.38	0.8	0.46

ALL VALUES = MG/KG

10-16

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

LAT	LON	SITE	NO.	Al	As		Ba		Cd		Cr		Cu		Fe			
					YB RM2.5	90478118	28,400	0.97	1.4	1.245	1.34	1.21	0.64	0.37	39.6	38.45	20.1	23.5
465846	1203919	YB290.3	91258436	24,300	24,900	1.4	1.245	1.34	1.21	0.64	0.37	39.6	38.45	20.1	23.5	40,200	41,700	
		YB RM2.6	90478119	25,500		1.09		1.08		<0.2				37.3	26.9		43,200	
465114	1201724	YB300.3	91258437	21,500	18,750	2.2	2.58	0.96	0.818	0.21	0.165	15.9	16.5	17.1	21.5	25,200	23,900	
		YB RM2.6	90478120	16,000		2.96		0.67		<0.2				17.1	25.9		22,600	
465112	1201624	YB310.3	91258438	14,500	17,000	1.3	1.65	0.94	0.89	0.42	0.26	11.3	13.15	12.8	16.4	27,500	30,050	
		YB RM2.6	90478121	19,500		2.0		0.84		<0.2				15	20		32,600	
470058	1203855	YB32.2	91258561	29,800	24,267	3.4	2.818	1.44	1.04667	0.75	0.36	18.6	21.2333	30.8	22.3333	406	16,369	
		YB320.3	91258434	17,400		1.6		0.92		0.2				19	15.5		21,800	
		YB RM2.3	90478122	25,600		2.0		0.78		<0.2				26.1	20.7		26,900	
		YB370.3RS	91258444	18,100	18,800	2.7	2.7	0.54	0.555	0.39	0.4	25.1	26.85	9.3	9.545	16,000	16,450	
		YB372.2RS	91258445	19,500		2.7		0.57		0.41				26.6	9.79		16,900	

ALL VALUES = MG/KG

10-17

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

ID#	LONG	SITE	NO.	Pb	Mg	Ca	Mn	Ni	Zn	Cu	As	Cr	Mo	Se	W
463937	1234536	SWRA2.5	90478080	12	12	537	637	0.119	0.119	26.8	26.8	63.1	63.1		
465952	1233542	SWRA2.5	90478081	9.7	9.7	303	303	0.093	0.093	19.6	19.6	53.8	53.8		
463110	1233352	SWRA2.5	90478082	4	4	930	930	0.055	0.055	63.2	63.2	86	86		
464120	1225527	SWRA2.3	90478083	4	4	277	277	0.042	0.042	11.9	11.9	44.5	44.5		
463337	1230623	SWRA2.3	90478084	10	10	633	633	0.061	0.061	14.2	14.2	63	63		
465553	1240957	SWRC2.5	90478086	3.2	3.2	159	159	0.009	0.009	10.3	10.3	24.4	24.4		
465125	1240634	SWRC2.6	90478087	2.3	2.3	149	149	0.01	0.01	10	10	27.5	27.5		
463628	1240232	SWRC2.6	90478088	2.1	2.1	107	107	0.011	0.011	9	9	21.1	21.1		
462602	1240317	SWRC2.5	90478089	3.1	3.1	112	112	0.011	0.011	8.7	8.7	24.6	24.6		
462116	1240157	SWRC2.5	90478090	2.3	2.3	78	78	0.009	0.009	7.6	7.6	24.1	24.1		
483954	1222930	SWRD2.3	90478092	5.2	5.2	229	229	0.021	0.021	22.3	22.3	36.7	36.7		
483908	1222926	SWRD2.3	90478093	6.1	6.1	197	197	0.038	0.038	31.3	31.3	42.4	42.4		
484152	1222929	SWRD2.6	90478094	3.8	3.8	231	231	0.031	0.031	19.1	19.1	45	45		
484809	1221033	SWRD2.7	90478095	4.7	4.7	366	366	0.045	0.045	39.8	39.8	54	54		
484332	1220527	SWRD2.5	90478096	12	12	631	631	0.185	0.185	91.1	91.1	116	116		
484833	1192416	SWRJ2.7	90478107	9.9	9.9	571	571	0.025	0.025	24.6	24.6	77.9	77.9		
483446	1192836	SWRJ3	90478108	5.4	5.4	345	345	0.01	0.01	7.8	7.8	39.4	39.4		
480522	1194153	SWRJ2.8	90478109	6.6	6.6	256	256	0.004	0.004	12.3	12.3	39.6	39.6		
482415	1192705	SWRJ3.2	90478110	4.8	4.8	234	234	0.007	0.007	17	17	31.4	31.4		
484313	1192153	SWRJ3	90478111	4.2	4.2	233	233	0.013	0.013	9.5	9.5	30.7	30.7		
473642	1204021	SWRL2.7	90478112	5	5	363	363	0.005	0.005	34.1	34.1	82.3	82.3		
473251	1203128	SWRL2.7	90478113	9.5	9.5	430	430	0.015	0.015	20.8	20.8	75.4	75.4		
473740	1203824	SWRL2.7	90478114	8.8	8.8	294	294	0.01	0.01	16.7	16.7	58.3	58.3		
472924	1202000	SWRL2.7	90478115	6.4	6.4	340	340	0.013	0.013	12.2	12.2	41	41		
472943	1202117	SWRL2.6	90478116	5.9	5.9	372	372	0.004	0.004	19.4	19.4	56.4	56.4		
470608	1175445	SWRP2.8	90478128	11.7	11.7	652	652	0.021	0.021	16.5	16.5	49.4	49.4		
465848	1174302	SWRP3	90478129	8	8	516	516	0.008	0.008	10.7	10.7	43.8	43.8		
462437	1180414	SWRP3	90478130	10.4	10.4	523	523	0.004	0.004	14	14	47.1	47.1		
461153	1180928	SWRP3	90478131	6.7	6.7	252	252	0.011	0.011	7.7	7.7	26.3	26.3		
461307	1181528	SWRP3.2	90478132	5.8	5.8	279	279	0.004	0.004	7.1	7.1	31.5	31.5		
470446	1191953	SWRR2.5	90478134	4.2	4.2	245	245	0.004	0.004	6.4	6.4	37.4	37.4		
470053	1194611	SWRR2.7	90478135	8	8	378	378	0.004	0.004	9.2	9.2	42.2	42.2		
464554	1184944	SWRR2.5	90478136	6.8	6.8	325	325	0.004	0.004	11.2	11.2	32.4	32.4		
465250	1194216	SWRR2.5	90478137	6	6	268	268	0.004	0.004	9.7	9.7	30.3	30.3		
462524	1190452	SWRR2.3	90478138	5.3	5.3	377	377	0.01	0.01	11.7	11.7	39.7	39.7		
454159	1223043	CL10.3	91238155	6.7	6.7	984	904.5	0.022	0.0205	17.7	19.05	85.5	83.8		
		CLRG12.2	90478102	9.9		825		0.019		20.4		82.1			

ALL VALUES = MG/KG

10-18

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

LAT	LON	SITE	NO	Pb	Mg	Ag	Ni	Zn	
454014	1224057	CL20.3	91238156	5.9	6.45	857	667.6	0.024	0.021
		CLRG22.2	90478103	5		478		0.018	
454050	1224424	CL30.3	91238157	14	11.3	837	665.5	0.038	0.0315
		CLRG32.2	90478104	8.6		494		0.025	
454653	1223558	CL40.3	91238158	6.7	7.7	1010	848	0.043	0.0425
		CLRG42.2	90478105	8.7		686		0.042	
454742	1224135	CL50.3	91238159	12	12.5	1210	927	0.041	0.0455
		CLRG52.2	90478106	13		644		0.05	
455548	1224243	CL60.3	91238160	<2	<2	230	150	0.025	0.01375
		CL62.2	91238161	<2		70		<0.005	
455207	1224355	CL70.3	91238162	6	4.65	256	231.5	0.033	0.031
		CL72.2	91238163	3.3		207		0.029	
453343	1221828	CL80.3A	91238169	13	12.04385	412	420.7692	0.041	0.047931
		CL80.3B	91238170	10		344		0.029	
		CL80.3C	91238173	30		485		0.03	
		CL80.3D	91238175	21.1		521		0.04	
		CL80.3V	91238164	17.8		450		0.04	
		CL80.8V	91238166	5.8		306		0.024	
		CL81.4V	91258511	6.9		307		0.025	
		CL82.2A	91238170	7.7		452		0.0706	
		CL82.2B	91238172	8		463		0.0749	
		CL82.2C	91238174	10		414		0.07	
		CL82.2D	91238176	8.3		483		0.08	
		CL82.2V	91238167	10.5		425		0.0696	
		CL83.0V	91238168	7.47		408		0.029	
455053	1223856	CL90.3	91258512	14	9.8	726	609.5	0.038	0.0285
		CL92.2	91258513	5.6		293		0.019	
455036	1223958	CL100.3	91238177	8	7.3	1180	926.5	0.03	0.035
		CL102.2	91238178	6.6		673		0.04	
454614	1223507	CL110.3	91238179	10.4	9.185	1100	829.6667	0.04	0.03
		CL112.2	91238180	7.97		562		0.02	
		CL312.2.3SS	91258446	3.6		827		0.026	
454745	1223805	CL120.3	91238181	14	12.23333	1688	1836	0.04	0.026667

ALL VALUES = MG/KG

10-19

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

LAT	LON	SITE	NO.	PD	Mg		Mg		Mg		Mg	
					1	2	3	4	5	6	7	8
454717	1223827	CL120.08V	91238193	13	2610		0.02		10.4		82.2	
		CL122.2	91238182	9.7	1210		0.02		16		66.9	
453623	1222654	CL130.3	91238183	9.5	8.65	365	807.5	0.03	0.02	7.9	12	55.3
		CL132.2	91238184	7.8		1250		0.01		16.1		73.3
454222	1223140	CL140.3	91238185	54	28.6	536	659	0.04	0.021667	12.4	13.766667	79.6
		CL280.3SS	91238209	24.8		529		0.005		13.4		78.1
		CL142.2	91238186	10		912		0.02		15.5		67
454503	1223605	CL150.3	91238187	10.4	8.733333	434	464.6667	0.03	0.033333	21	15.366667	73.9
		CL282.2SS	91238210	8.1		420		0.04		14.3		63.9
		CL152.2	91238188	7.7		540		0.03		12.6		63.5
454552	1224208	CL170.3	91238191	16.3	13.7	2140	1525.5	0.03	0.02	117	66.75	102
		CL172.2	91238192	11.1		911		0.01		16.5		87.5
453449	1221647	CL180.3	91258504	13.9	10.733333	1770	1483.333	0.039	0.031	17.6	18.833333	92.1
		CL182.2	91258505	11		1370		0.027		19		89
		CL292.2SS	91258510	7.3		1310		0.027		19.9		86.9
454854	1223018	CL190.08V	91238193	13	10.77143	2610	1960.867	0.02	0.02	10.4	14.32557	82.2
		CL190.3	91238197	14.2		1100		0.02		15.6		79.1
		CL190.3V	91238194	14.1		1870		0.03		12		78
		CL191.0V	91238212	9.2		1850		0.035		13.4		70.4
		CL191.6V	91238195	7.6		4060		0.01		14.3		69.7
		CL192.2	91238198	9.6		616		0.005		20.4		58.8
		CL192.2V	91238196	7.7		1620		0.02		14.2		61.5
454442	1224133	CL200.3A	91238211	11	11.09	1610	1192.154	0.025	0.025546	16.3	16.46154	90.1
		CL200.3B	91258514	12		1430		0.033		16.5		98.1
		CL200.3C	91238201	11		1670		0.03		15.7		89.7
		CL200.3D	91238203	10		1730		0.02		16.6		84.5
		CL200.3V	91258500	14.5		1430		0.033		15.6		83.3
		CL200.8V	91258501	12.7		1330		0.024		15		89
		CL201.8A	91258518	9.2		1240		0.028		16.3		83.8
		CL201.8B	91258515	8.1		1300		0.016		14.1		88.9
		CL201.8C	91238202	11		1040		0.02		17.4		83.5
		CL201.8D	91258517	10		743		0.025		16.7		87.4
		CL201.8V	91258502	6.27		387		0.028		9.9		46.3
		CL203.0V	91258503	16		804		0.034		22.4		91.3

ALL VALUES = MG/KG

10-20

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

ID#	LOCN	SITE	NO.	Pb	Mg	Hg	Ni	Cd	Zn	Cu	As	Mn	Cr	V	Hg
455307	1223815	CL210.3	91238204	16	15.975	1640	1077.25	0.02	0.0285	15	18.9	76.1	73.9	72.1	72.5
			91238205	14		639		0.03			18.2				
453958	1223100	CL220.3	91258506	18	15	1160	983.75	0.033	0.0266	20.8	17.975	98.8	92.1	94.6	92.1
			91258507	15		870		0.031			21.6				
453748	1223115	CL230.3	91258508	18	12.9	963	962.5	0.029	0.0192	13.8	14.75	100	92.5	95.7	92.5
			91258509	7.8		942		0.0094			15.7				
454215	1223453	CL240.3		9.6	9.1	986	1042	0.037	0.0205	19	18.5	98.6	97.7	97.7	97.7
		CL300.3SS	91258447	8.8		1100		0.03			17				
		CL242.2	91238206	8.9		1040		0.004			19.5				
454200	1223313	CL250.3	91238207	7.8	7.45	989	902.5	0.02	0.0125	17.6	19	96.4	92.2	92.2	92.2
		CL252.2	91238208	7.1		816		0.005			20.4				
453654	1222824	CL260.3	91258516	8.7	6.7	928	961	0.029	0.022	17.7	17.4	100	97.3	97.3	97.3
		CL262.2	91258519	4.7		974		0.015			17.1				
		CL270.3RS	91258520	4.7	4.15	258	262.5	0.046	0.0468	26.1	13.0735	29.1	29.65	29.65	29.65
		CL272.2RS	91258521	3.6		247		0.047			0.047				
472129	1220717	PSL1A0.5	87278100	29	29	846	846	0.06	0.06	22	22	56	56	56	56
472256	1220642	PSL2A0.5	87278101	<4	<4	163	163	0.047	0.047	22	22	31	31	31	31
472317	1220642	PSL3A0.1	87278104	<4	<4	420	310	0.027	0.0292	25	23	49	38	38	38
		PSL3A0.5	87278105	<4		373		0.036			21				
		PSL5AO.5DUP	87278102	<4		412		0.035			21				
		PSL3A1.0	87278106	<4		163		0.036			27				
		PSL3A4.0	87278107	<4		184		0.012			22				
472407	1220657	PSL4A0.5	87278108	<4	<4	299	299	0.042	0.042	18	18	29	29	29	29
472410	1220657	PSL4B0.5	87278109	<4	<4	239	228	0.052	0.033	20	22	27	29	29	29
		PSL6A0.5	87278111	<4		231		0.02			25				
		PSB8AO.5DUP	87278147	<4		215		0.027			22				
472220	1220800	PSB1A0.5	87278112	<4	<4	763	763	0.052	0.052	34	34	58	58	58	58
472308	1221004	PSB2A0.5	87278113	<4	<4	494	374.5	0.058	0.052	23	23	39	39	39	39
		PSB6AO.5DUP	87278145	<4		255		0.046			23				

ALL VALUES = MG/KG

10-21

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

ID#	LONG	SITE	NO.	Pb	Mg	Ni	Cu	Zn	As	Cr	Mo	Se	U
472404	1220945	PSB3A0.1	87278114	<5	2,126	916	499	0.058	0.0445	24	27	71	43
		PSB3A1.0	87278118	<4		595		0.042		28		41	
		PSB3A3.0	87278123	<4		161		0.051		25		26	
		PSB3A5.0	87278124	<4		324		0.027		29		32	
472405	1220943	PSB3B0.1	87278128	<4	<4	562	302	0.052	0.02775	17	22	42	33
		PSB3B1.0	87278129	<4		291		0.028		28		41	
		PSB3B2.0	87278130	<4		138		0.012		21		23	
		PSB3B4.0	87278131	<4		218		0.019		22		26	
472406	1220941	PSB3C0.1	87278132	15	6,26	1,310	474	0.058	0.03325	16	23	54	33
		PSB3C2.0	87278133	<4		232		0.035		24		29	
		PSB3C4.0	87278134	<4		141		0.02		24		26	
		PSB3C5.0	87278135	<4		212		0.02		27		24	
472405	1220942	PSB3D1.0	87278136	<4	<4	321	321	0.028	0.028	24	24	34	34
472404	1220944	PSB3E1.0	87278139	<4	<4	738	738	0.058	0.058	25	25	38	38
472508	1220914	PSB4A0.1	87278140	<4	<4	143	141	0.043	0.0355	17	17	33	29
		PSB4A0.5	87278141	<4		164		0.043		17		33	
		PSB4A2.0	87278142	<4		137		0.04		19		27	
		PSB7A2.0 DUP	87278146	<4		122		0.041		16		26	
		PSB4A4.0	87278143	<4		141		0.011		16		24	
472653	1221116	PSB5A0.5	87278144	<4	<4	90	90	0.012	0.012	9	9	12	12
472143	1220734	PSSED1A	87278148	<4	<4	2,750	2750	0.076	0.076	16	16	99	99
472129	1220742	PSSED1B	87278149	397	207.5	367	818.6	0.037	0.036	22	21.5	101	82
		PSSED1C	87278150	18		1,270		0.035		21		63	
472131	1220725	PSSED2A	87278151	<4	<4	721	607	0.035	0.027	23	23	96	90.5
		PSSED2B	87278152	<4		493		0.019		23		85	
472112	1220742	PSSED3A	87278153	<4	<4	1,090	2170	0.023	0.0475	25	25	57	71
		PSSED3B	87278154	<4		3,250		0.072		25		85	
483845	1225008	PS10.3	93088619	16	10.26	1210	951.6	0.0726	0.04974	29.8	36.86	59.6	54.6
		PS300.3 DUP	93088637	13		1090		0.0671		25.3		54.6	
		PS12.2	93088520	5.8		819		0.046		30		43.6	
		PS302.2 DUP	93088638	5.5		972		0.04		22.8		40.5	

ALL VALUES = MG/KG

10-22

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

LAT	LONG	SITE	NO.	Pb	Mg		Hg		Ni		Zn	
					PS155	93088521	11	667	0.023	76.4	74.7	79
483355	1225604	PS20.3	93088522	6.5	6.033333	654	623	0.039	0.028	21.3	19.7	65.1
		PS270.3DUP	93088631	6.3		637		0.029		17.5		65.4
		PS22.2	93088523	5.3		459		0.019		22.7		44.7
		PS272.2DUP	93088632	4.2		342		0.015		13.3		35.1
485910	1223507	PS30.3	93088524	10	6.866667	538	609.6667	0.043	0.037333	25.9	24.66667	82.5
		PS32.2	93088525	5.2		298		0.043		28.5		59.4
		PS355	93088526	5.4		693		0.026		19.6		59.6
481630	1214308	PS40.3V	93088527	18	29.47857	663	669.9286	0.0712	0.094407	53.7	64.68571	109
		PS320.3SS	93088641	16		586		0.0665		48.4		100
		PS41.0V	93088528	12		854		0.0571		51.8		110
		PS42.2V	93088529	20		484		0.195		62.5		83.3
		PS43.0V	93088530	9.4		520		0.143		58.9		94.5
		PS44.9V	93088531	13		513		0.109		62.3		116
		PS40.3A	93088532	61.3		819		0.044		51.8		227
		PS40.3B	93088533	16		660		0.0986		54.1		104
		PS40.3C	93088534	182		673		0.0928		48.1		173
		PS40.3D	93088535	14		934		0.0521		39.9		105
		PS42.2A	93088536	12		506		0.114		59.6		95.7
		PS42.2B	93088537	14		611		0.106		59.1		108
		PS42.2C	93088538	14		793		0.0829		53.8		103
		PS42.2D	93088539	11		623		0.0895		61.6		106
480938	1224043	PS50.3	93088540	6.7	6.9	804	657.6	0.036	0.0285	24.1	25.8	63.2
		PS51.5	93088541	5.1		311		0.021		27.5		45.1
480239	1231923	PS60.3	93088542	6.7	6.133333	471	661	0.044	0.03	14	17.06667	32.5
		PS62.2	93088543	3.8		314		0.027		17.5		35.4
		PS655	93088544	4.9		898		0.019		19.7		39.5
471643	1220203	PS70.3V	93088545	14	6.621429	422	360.6714	0.0616	0.043457	22.3	18.17143	56.6
		PS71.4V	93088546	5.3		485		0.0506		14.3		56
		PS72.2V	93088547	3.2		319		0.021		17.6		32.1
		PS73.0V	93088548	4.3		429		0.0523		14		58.3
		PS73.8V	93088549	7.3		438		0.0532		14.8		57.3
		PS70.3A	93088550	9.1		366		0.0591		19.4		45.6
		PS70.3B	93088551	9		379		0.0565		16.4		43.1
		PS70.3C	93088552	8.2		315		0.0591		17.5		42.6
		PS310.3SS	93088639	9.9		316		0.044		16.8		44.5
		PS70.3D	93088553	6.4		251		0.032		18.3		36.5
		PS72.2A	93088554	3.4		262		0.026		22.8		36.4

ALL VALUES = MG/KG

10-23

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

LAT	LON	SITE	NO.	Pb	Mn	Hg	Ni	Zn	As	Cd	Cr	Co	Cu	Fe	Mg	Mo	Se	U	V	W	Y	Zr
475035	1214917	PS72.2B	93088555	3.2	247	0.027	19.3	36.2														
		PS72.2C	93088556	4.6	363	0.032	21.4	40.6														
		PS72.2D	93088557	3.4	326	0.034	19.5	37.2														
474226	1225456	PS80.3	93088558	23	16.2	493	525.5	0.107	0.09395	29.3	34.95	41.2	48.8									
		PS82.2	93088559	9.4		558	0.0809			40.6		52.4										
475420	1225412	PS90.3	93088560	12	9.9	1720	1291.5	0.0569	0.05495	32.1	36.3	90.8	89.4									
		PS91	93088561	7.8		863	0.0528			40.5		88										
471843	1223157	PS100.3	93088562	11	8.2	276	276.5	0.0535	0.04475	21.6	21.5	33.4	32.3									
		PS102.2	93088563	5.4		277	0.036			21.4		31.2										
472827	1224307	PS110.3V	93088564	19	22.01838	510	383.3077	0.043	0.077308	24.8	28.24616	65.9	43.95385									
		PS111.4V	93088565	6.7		267	0.042			28.4		45.4										
		PS112.2V	93088566	5.5		193	0.04			30.2		35.8										
		PS113.0V	93088567	7.9		289	0.0816			33.6		39.6										
		PS114.0V	93088568	11		462	0.0562			25.5		28.3										
		PS110.3A	93088569	94.1		908	0.215			12.6		52.1										
		PS110.3B	93088570	19		321	0.072			27.7		44.6										
		PS110.3C	93088571	66.3		428	0.198			20.3		62.9										
		PS110.3D	93088572	29.9		585	0.0562			23.2		56.6										
		PS112.2A	93088573	6		153	0.05			24.7		29.7										
		PS112.2B	93088574	5.8		312	0.027			23.6		28.8										
		PS112.2C	93088575	9.6		348	0.083			27.9		47.2										
		PS112.2D	93088576	5.4		207	0.041			25.7		34.5										
471723	1232215	PS120.3	93088577	8.5	6.233333	241	193.6667	0.0541	0.046033	20.9	24.63333	24.2	24.43333									
		PS122.2	93088578	4.6		172	0.049			27.2		26.6										
		PS292.2SS	93088636	2.6		138	0.032			25.8		22.5										
472232	1225818	PS130.3	93088579	3.9	4.25	2020	1670	0.0717	0.056335	55.2	57.45	135	132.5									
		PS132.2	93088580	4.6		1320	0.041			59.7		130										
465504	1225420	PS140.3	93088581	7.6	4.733333	1210	591.6667	0.045	0.0302	23.5	25.23333	55.1	43									
		PS141.5	93088582	3.7		303	0.037			29.9		39.9										
		PS1455	93088583	2.9		262	0.0086			22.3		34										
465504	1225420	PS150.3V	93088584	5.7	4.25	603	367.2143	0.02	0.021779	22.8	21.62857	47	40.61429									
		PS151.2V	93088585	2.9		425	0.022			22.5		42.8										
		PS152.2V	93088586	2.7		302	0.025			22		39.3										
		PS153.0V	93088587	2.7		210	0.0086			21.5		37.7										
		PS154.3V	93088588	3.9		227	0.0093			19.2		36.2										
		PS312.2SS	93088640	2.9		249	0.016			21.2		35.4										

ALL VALUES = MG/KG

10-24

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

LAT	LON	SITE	NO	Pb	Mg	Mn	Ni	Zn	As	Cd	Cr	Hg	Se	U
480812	1221653	PS150.3A	93088589	4.9	312		0.032		21.3		40.1			
		PS150.3B	93088590	6.9	764		0.025		21		47.2			
		PS150.3C	93088591	6.5	799		0.027		21.7		47.3			
		PS150.3D	93088592	6.2	348		0.027		20.8		41			
		PS152.2A	93088593	3.6	183		0.022		20.5		37.2			
		PS152.2B	93088594	3.8	230		0.024		21.4		36.6			
		PS152.2C	93088595	3.1	232		0.02		23		38.2			
		PS152.2D	93088596	3.7	257		0.027		23.9		42.6			
471307	1222000	PS160.3	93088597	22.5	13.6	405	306.8	0.064	0.046	21.7	29.9	51.1	46.16	
		PS161.2	93088598	4.5		208		0.028		38.1		39.2		
471055	1241132	PS170.3	93088599	12	7.9	250	218	0.0623	0.04265	11.6	10.65	46.5	36.3	
		PS172.2	93088600	3.8		182		0.023		9.7		26.1		
474657	1241729	PS180.3	93088601	20.2	10.975	233	262.76	0.0799	0.066726	7	12.05	32.9	43.66	
		PS182.2	93088602	9.1		274		0.108		11.2		37.6		
		PS282.2SS	93088634	7.1		287		0.045		14.8		54.3		
		PS1855	93088603	7.5		217		0.03		15.2		49.8		
473919	1222451	PS190.3	93088604	5.9	6.1	134	234.5	0.0919	0.063633	6.1	12.975	30.1	47.85	
		PS192.2	93088605	6.9		300		0.045		15.8		56.4		
		PS1955	93088606	5.5		500		0.024		12.7		54.1		
470353	1221824	PS200.3V	93088607	19	13.72667	516	284.3333	0.0541	0.066833	25.7	27.26687	35.2	32.3	
		PS200.8V	93088608	5.1		264		0.031		27.3		28.9		
		PS202.2V	93088609	<2		129		0.028		20.6		19.9		
		PS203.0V	93088610	<2		193		0.023		27.5		22.9		
		PS204.5V	93088611	2.7		244		0.032		27.3		25.2		
		PS200.3A	93088612	46.1		621		0.28		27.2		48.6		
		PS290.3SS	93088635	42.4		519		0.231		27.4		48.1		
		PS200.3B	93088613	37.8		330		0.101		31.6		45.3		
		PS200.3C	93088614	21.9		341		0.0674		27.3		40.6		
		PS200.3D	93088615	11		228		0.033		29		32.4		
		PS202.2A	93088616	3.3		149		0.028		29.7		24.9		
		PS280.3SS	93088633	4.9		252		0.029		22.9		38.7		
		PS202.2B	93088617	2.9		148		0.023		28.6		24.4		
		PS202.2C	93088618	3.1		147		0.022		30.7		25.1		
		PS202.2D	93088619	3.7		184		0.02		26.2		24.3		
		PS210.3	93088620	10	10	1020	679.5	0.0869	0.07595	12.6	19.1	36.9	41.7	
		PSWRF2.7	90478097	10		339		0.065		25.6		46.5		
465501	1223333	PS220.3	93088621	3.8	4.6	697	740	0.023	0.0266	11.9	21.7	54.2	58.46	

ALL VALUES = MG/KG

10-25

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

ID#	LON	SITE	NO.	Pb			Mn	Ni	Cu	Zn	Cd	Hg	As	Pb
					PSWRF2.5	90478098	5.4	783	0.03	31.5	62.7	32.7		
465728	1223904	PS230.3	93088622	3.5	4.76	386	386	0.034	0.0365	11.6	17.36	27.5	32.7	
		PSWRF2.5	90478099	6		344		0.039		23.1		37.9		
475451	1221040	PS240.3	93088623	13	10.18	784	770.6	0.0595	0.06325	32.8	44.6	72.2	81.46	
		PSWRF2.5	90478100	7.3		757		0.047		56.2		90.7		
482413	1221025	PS250.3	93088624	4	3.8	245	361.5	0.028	0.043	131	244.5	38.8	43.35	
		PSWRF2.7	90478101	3.6		478		0.058		358		47.9		
464743	1221631	PSLB10.3	93088625	31.5	13.8	364	387.5	0.0665	0.06675	9.8	10.06	67.3	52.36	
		PSLB12.2	93088626	7.5		411		0.047		10.3		37.4		
472742	1221326	PSLB20.3	93088627	4.4	4.45	772	753.5	0.049	0.0631	43.5	52.7	72.6	78.1	
		PSLB22.2	93088628	4.5		735		0.0772		61.9		83.6		
460223	1184019	PS260.3RS	93088629	5.9	6.95	420	411	0.0065	0.0068	11.4	10.66	47.6	47.95	
		PS262.2RS	93088630	6		402		0.0071		9.9		48.3		
472457	1184356	SB10.3	92268500	8	6.76	364	366	0.017	0.0172	7.3	5.325	47.3	46.15	
		SB30.3SS	92268574	8.3		353		0.017		7.5		49.8		
		SB12.2	92268501	5		369		0.029		8.4		41.7		
		SB320.3SS	92268573	5.7		378		0.0058		10.1		45.8		
473910	1180946	SB20.3	92268502	15	14.33333	443	463.3333	0.016	0.014333	8.4	9.466667	54.6	51.8	
		SB340.3SS	92268575	15		435		0.013		8.6		55.6		
		SB22.2	92268503	13		512		0.014		11.4		45.2		
475026	1175046	SB30.3	92268504	11	12	515	470	0.013	0.009476	7.6	9.2	51.9	63.3	
		SB32.2	92268505	13		526		0.0074		10		54.4		
		SB270.3 SS	92268568	14		520		<0.005		10.5		58.5		
		SB3SSBBD	92268506	10		319		0.015		8.7		48.4		
470819	1174318	SB40.3	92268507	8.2	8.8	418	436	0.018	0.019	12.3	12.2	41.2	41.05	
		SB41.2	92268508	9.4		454		0.02		12.1		40.9		
474232	1173037	SB50.3	92268509	9.1	10.06	586	558	0.035	0.0225	8	8.7	70.6	67.46	
		SB51.3	92268510	11		530		0.01		9.4		64.3		
480033	1172325	SB60.3	92268511	9.6	8.75	730	577.75	0.012	0.01225	11.1	9.875	58.5	46.3	
		SB290.3SS	92268570	10		1170		0.012		11.8		66.3		
		SB62.2	92268512	8.8		242		0.009		10		38.6		
		SB6SS	92268513	6.6		169		0.016		6.6		21.8		

ALL VALUES = MG/KG

10-26

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

LAT	LON	SITE	NO	Pb	Mn	Ag	Ni	M	Zn		
481824	1173603	SB70.3	92268514	10	8.666667	847	657.3333	0.022	0.012667	9.8	8.1
		SB71.8	92268515	12		597		0.0067		10.2	81.9
		SB7SS	92268516	4		228		0.0093		4.3	32.8
475949	1181738	SB80.3	92268517	17	15.666667	488	446	0.013	0.0105	9.1	10.033333
		SB310.3SS	92268572	18		452		0.011		10.2	57
		SB82.2	92268518	12		398		0.0075		10.8	44.6
485517	1173112	SB90.3	92268519	15	12.833333	434	394.3333	0.025	0.0168	18.1	16.7
		SB91.4	92268520	14		535		0.018		20	58
		SB9SBD	92268521	9.5		214		0.0074		12	98.1
480433	1171952	SB100.3	92268522	17	16	858	655	0.021	0.0185	11.6	11.8
		SB102.2	92268523	15		452		0.016		12	63.6
474434	1175413	SB110.3	92268524	15	13.6	514	661.25	0.015	0.014625	13.5	12.55
		SB111.3	92268525	12		777		0.0085		13.2	60
		SB350.3SS	92268576	15		456		0.024		12.7	59.4
		SB11SBD	92268526	12		498		0.011		10.8	61.5
474018	1174407	SB120.3	92268527	11	10.6	514	505	0.014	0.0215	14	16.4
		SB122.2	92268528	10		496		0.029		18.8	42.6
471929	1170403	SB130.3	92268529	10	10.875	550	764.75	0.018	0.01625	16	15.775
		SB300.3SS	92268571	12		656		0.017		15.4	51.9
		SB132.2	92268530	13		1030		0.02		19.9	48
		SB13SBD	92268531	8.5		823		0.01		11.8	38.6
472534	1171355	SB140.3	92268532	10	9.05	469	390.875	0.027	0.014063	12.6	10.86125
		SB142.2	92268533	9.4		481		0.017		12.2	50.3
		SB140.3V	92268534	9.3		445		0.019		11.7	46
		SB140.8V	92268535	10		411		0.013		10.8	46.2
		SB142.2V	92268536	8.3		381		0.01		10.3	37.8
		SB280.3SS	92268569	11		397		<0.005		11.2	43.6
		SB143.7V	92268537	7.4		305		0.013		9.61	36.7
		SB145.0V	92268538	7		238		0.011		8.4	34
470433	1171952	SB150.3	92268539	12	10.8	614	638.5	0.017	0.014	12	12.05
		SB152.2	92268540	9.6		663		0.011		12.1	37.4
472343	1172004	SB160.3	92268541	9.3	10.65	498	599	0.014	0.01195	17.5	18.6
		SB162.2	92268542	12		700		0.0099		19.7	48.9

ALL VALUES = MG/KG

10-27

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

STN	LOC	SITE	NO.	Pb	Mn	As	Cd	Hg	Ni	Zn			
474257	1174500	SB170.3	92268543	16	15	477	476	0.0096	0.008	11.2	12.35	61.5	56
		SB172.2	92268544	14		473		0.0064		13.5		50.5	
474346	1170832	SB180.3	92268545	11	11.5	601	461	0.019	0.01075	10.4	9.75	62.2	55.65
		SB182.2	92268546	12		321		<0.005		9.1		49.1	
475233	1173614	SB190.3V	92268547	14	18.77857	464	417.4286	0.017	0.006164	10.5	10.36643	54.2	60.89286
		SB191.2V	92268548	14		354		<0.005		10		51.1	
		SB192.2V	92268549	15		330		<0.005		10.7		43.9	
		SB193.6V	92268550	23.9		349		<0.005		12.2		41.3	
		SB194.4V	92268551	17		371		<0.005		11.6		45.8	
		SB190.3A	92268552	14		563		<0.005		10.6		66.2	
		SB192.2A	92268553	14		490		0.0069		12		61.7	
		SB190.3B	92268554	15		508		0.0096		10.3		53.8	
		SB192.2B	92268555	13		276		<0.005		8.73		35.2	
		SB190.3C	92268556	16		483		0.0058		10.2		54	
		SB192.2C	92268557	17		424		0.0147		12.5		50.8	
		SB190.3D	92268558	14		501		<0.005		8.3		49.8	
		SB192.2D	92268559	14		299		0.0053		8.9		38.5	
		SB19.SS	92268560	20		432		0.0095		8.6		66.2	
474232	1171937	SB200.3	92268561	9.9	8.35	600	611	0.256	0.1312	5.2	4.8	59.9	69.4
		SB202.2	92268562	6.8		622		0.0064		4.6		76.9	
473743	1171000	SB210.3	92268563	12	12.8	518	454	<0.005	0.00425	9.3	9.8	58.2	63.9
		SBRU2.3	90478140	13.6		390		0.006		10.3		49.6	
474313	1173053	SB220.3	92268564	13	12.5	682	555	0.012	0.012	10.3	12.45	53.9	60.36
		SBRU2.5	90478141	12		428		0.012		14.6		46.8	
475037	1175147	SB230.3	92268565	11	11	441	445.6	0.0087	0.00635	8.9	11.4	40.3	44.25
		SBRU2.8	90478142	11		450		0.004		13.9		48.2	
475002	1175805	SB240.3	92268566	10	10.6	382	376.6	<0.005	0.00475	8.8	9.65	43.5	44.05
		SBRU2.6	90478143	11.2		371		0.007		10.5		44.6	
475232	1180911	SB250.3	92268567	8.5	9.6	365	384.6	0.0053	0.00566	9.1	10.15	41.1	42
		SBRU2.6	90478144	10.5		344		0.006		11.2		42.9	
475453	1172838	SB380.3	92268577	12	10.65	496	374	0.0083	0.0054	10.4	9.85	62	53.35
		SB382.2	92268578	9.3		252		<0.005		9.3		44.7	
475349	1171054	SB390.3	92268579	8.6	7.8	1140	769.6	0.0079	0.0066	6.4	4.6	34.7	29.7

ALL VALUES = MG/KG

10-28

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

LAT	LON	SITE	NO.	Pb	Mn	Hg	Mo	Zn	As	Cd	Cr	Co	Ni	U
		SB391.5	92268580	7	399	0.0051		3.8		24.7				
463437	1205022	YB10.3	91258554	4.5	4.5	761	0.017	0.017	9.8	9.8	60.6	60.6		
463222	1202650	YB20.3	91258556	6.2	6.2	510	0.014	0.014	19.3	19.3	53.6	53.6		
463153	1203223	YB30.3	91258558	5.9	5.9	613	0.011	0.011	14.8	14.8	55.9	55.9		
462623	1195653	YB40.3	91258559	7.3	7	552	0.013	0.0165	17.6	19.1	54.6	52.7		
		YB42.2	91258560	6.7		435	0.02		20.6		50.8			
461355	1192417	YB50.3A	91258566	6.8	9.657143	461	0.014	0.017714	13.5	14.95	51.9	58.46429		
		YB50.3B	91258568	4.4		437	0.011		11.9		45.4			
		YB50.3C	91258537	11		469	0.026		15.1		56.8			
		YB50.3D	91258539	9.7		505	0.019		14.2		58.9			
		YB50.3V	91258574	11		465	0.018		12.5		55			
		YB340.3SS	91258582	11		470	0.017		14.5		55.8			
		YB50.7V	91258575	9.5		525	0.014		14.1		58.9			
		YB51.3V	91258576	12		477	0.016		18		62.7			
		YB52.2A	91258567	9.3		546	0.02		15.1		65.4			
		YB52.2B	91258564	5.5		435	0.012		13.9		51.3			
		YB52.2C	91258538	9.2		518	0.016		15.4		65.5			
		YB52.2D	91258540	9.8		505	0.021		16.3		63.3			
		YB52.2V	91258577	13		484	0.025		16.6		60.4			
		YB53.2V	91258565	13		535	0.019		18.2		67.2			
461445	1200151	YB60.3	91258562	8	6.433333	875	0.028	0.030333	36.6	40.36667	73.3	77.43333		
		YB332.2SS	91258569	7.2		876	0.027		37.9		79.3			
		YB62.2	91258563	4.1		769	0.036		46.6		79.7			
460709	1204921	YB70.3	91258421	5.15	3.875	1460	0.029	0.023	11.4	13.55	92.5	90.7		
		YB72.2	91258422	2.6		1290	0.017		15.7		88.9			
460959	1203706	YB80.3	91258423	4.6	4.066667	681	0.022	0.028333	14	16.06667	58.5	60.7		
		YB362.2	91258429	3.1		638	0.021		12.5		56.6			
		YB81.8	91258424	4.5		694	0.042		21.7		67			
461920	1202619	YB90.3A	91258571	3.7	2.171429	250	0.023	0.018914	12.5	13.26357	52.4	48.60714		
		YB90.3B	91258573	<2		514	0.019		10.7		47.3			
		YB90.3C	91258578	<2		1350	0.016		13.4		51.3			
		YB342.2SS	91258583	2.1		1160	0.022		11.8		50.4			
		YB90.3D	91258581	2.4		475	0.014		11.8		53.8			
		YB90.3V	91258417	2.7		412	0.019		9.2		44.3			
		YB90.7V	91258418	<2		392	0.014		4.9		28			

ALL VALUES = MG/KG

10-29

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

LAT	LON	SITE	NO.	Pb	Mn	Ni	M	Zn	
462827	1202727	YB92.2A	91258572	2.3	566	0.019	18	53.8	
		YB92.2B	91258580	<2	354	0.0058	9.45	32.8	
		YB92.2C	91258579	2.6	729	0.011	14.2	48.2	
		YB92.2D	91258541	<2	501	0.016	10.1	43.3	
		YB92.2V	91258419	2.3	507	0.02	12.3	42.8	
		YB93.5V	91258420	<2	756	0.031	24.3	62	
		YB95.0V	91258570	6.3	971	0.035	22.9	68.7	
464415	1203715	YB100.3	91258542	8.3	6.1	701	708.5	0.02	0.0275
		YB102.2	91258543	3.9		716		0.035	17
		YB110.3	91258544	5.1	9.133333	501	427.6667	0.012	0.0406
		YB360.3SS	91258412	3.3		397		0.046	19.6
		YB112.2	91258411	19		385		0.0638	10.8
		YB12.2	91258555	<2	6.4	607	564.4286	0.0085	0.030464
471215	1205848	YB120.3A	91258430	6.5		543		0.018	8.7
		YB120.3B	91258432	8.7		593		0.015	18.3
		YB120.3C	91258413	6.9		668		0.016	40.3
		YB120.3D	91258415	7.3		660		0.016	39.9
		YB120.3V	91258425	2.6		936		0.022	59.8
		YB120.7V	91258426	<2		583		0.032	57.5
		YB121.0V	91258427	2.3		514		0.032	44.7
		YB122.2A	91258431	7.3		434		0.017	67.6
		YB122.2B	91258433	7.4		385		0.014	70.2
		YB122.2C	91258414	7.4		433		0.017	133
		YB122.2D	91258416	8.2		466		0.17	40.3
		YB122.2V	91258428	3.8		555		0.026	44.1
		YB123.2V	91258526	5.2		525		0.023	51.3
471015	1205856	YB130.3	91258404	5.1	8.5	1250	1119	0.022	0.082
		YB350.3SS	91258408	7.9		1540		0.17	35.1
		YB132.2	91258405	6.5		567		0.054	38
470505	1202520	YB140.2	91258524	7.6	4.8625	809	1546.125	0.014	0.0123
		YB140.2V	91258545	5.5		1610		0.014	14.2
		YB140.6V	91258546	4.5		1600		0.015	16.1
		YB330.3SS	91258551	4		2000		0.013	14.7
		YB141.0	91258523	5.1		1050		0.018	16.4
		YB141.0V	91258547	4.5		2110		0.0088	16.4
		YB141.7V	91258548	3.4		1740		0.0088	16.4
		YB142.5V	91258525	4.3		1450		0.0068	19.3
465850	1204027	YB150.3	91258549	8.2	7.05	725	741.6	0.015	0.016
								14.8	16.1
								49.3	65.5
								51.36	64.6

ALL VALUES = MG/KG

10-30

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

LAT	LON	SITE	NG	Pb	Mn	Hg	Ni	Cu	Zn	Cd	As	Hg
				YB151.6	91258550	5.9						
471047	1204419	YB160.3	91258406	4.9	7.166667	539	586.6887	0.016	0.017333	23.3	24	45
		YB352.2SS	91258409	8.3		554		0.018		22.3		44.3
		YB162.2	91258407	8.3		604		0.018		26.4		43.6
471407	1204807	YB170.3	91258552	5.4	6.3	647	631	0.016	0.032	40.4	48.26	44.4
		YB172.1	91258553	5.2		615		0.048		56.1		43.1
463713	1211038	YB180.3	91258528	5.1	6.4	1440	1008	0.021	0.024	15.8	17.3	61.7
		YB182.2	91258527	5.7		576		0.027		18.8		54.75
462441	1205344	YB190.3	91258403	6.9	6.728571	1248	1210.857	0.018	0.016143	11.8	12.68571	111
		YB190.3V	91258529	6.1		1250		0.014		12.1		112
		YB190.7V	91258530	5.7		1020		0.014		12		95.4
		YB191.2V	91258400	6.3		1110		0.015		13.6		87.1
		YB192.2	91258410	9.4		998		0.016		11.6		76.3
		YB192.2V	91258401	7.1		1350		0.015		15.3		85.6
		YB194.0V	91258402	5.6		1500		0.021		12.4		91.8
470048	1210530	YB200.3	91258533	7	6.65	261	164.45	0.015	0.0155	2.6	2.16	54.7
		YB201.0	91258534	6.3		67.9		0.016		1.7		36.7
472528	1203915	YB210.3	91258535	21.2	17.1	863	786.6	0.118	0.1165	187	163	84
		YB210.8	91258536	13		710		0.115		139		73.7
472417	1212858	YB22.2	91258557	5.4	15.2	575	384.3333	0.026	0.051	28.4	14.53333	54.6
		YB220.3	91258531	31.8		286		0.0708		5.5		26.7
		YB222.0	91258532	8.4		292		0.0562		9.7		36.5
461432	1191954	YB230.3	91258439	6.6	7.4	396	392.6	0.0085	0.06725	13	12.9	45.7
		YBRO2.5	90478123	8.2		389		0.006		12.8		41.5
461727	1194425	YB240.3	91258440	7.8	8.26	432	396.6	0.022	0.0205	18.3	17.4	48.9
		YBRO2.5	90478124	8.7		361		0.019		16.5		44.7
462522	1204526	YB250.3	91258441	8	8.1	524	494.5	0.011	0.021	15.7	16.35	50.6
		YBRO2.5	90478125	8.2		465		0.031		17		45.55
461843	1202937	YB260.3	91258442	8.5	9.7	561	520.6	0.016	0.0265	17.8	18.35	58.7
		YBRO2.3	90478126	10.9		480		0.037		18.9		47.4
464114	1203916	YB270.3	91258443	5.1	6.05	411	386	0.0877	0.07435	15	15.36	58.4
		YBRO2.2	90478127	7		361		0.061		15.7		42.4

ALL VALUES = MG/KG

10-31

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

LAT	LONG	SITE	NO.	Pb		Mn		Hg		Ni		Zn		
470433	1202247	YB280.3	91258435	5.2	7.3	596	640.6	0.012	0.011	7.4	8.56	65.7	68.1	
			90478118	9.4		485		0.01		9.7		70.5		
465846	1203919	YB290.3	91258436	6.5	7.86	680	680	0.01	0.01	28	28.95	69.7	75.2	
			90478119	9.2		680		0.01		29.9		80.7		
465114	1201724	YB300.3	91258437	6.1	6.35	519	486	0.019	0.0346	15.3	20.96	44.7	40.85	
			90478120	6.6		453		0.05		26.6		37		
465112	1201624	YB310.3	91258438	5.2	6.55	618	716	0.011	0.0105	9.6	10.7	48	46.6	
			90478121	7.9		814		0.01		11.8		45.2		
470058	1203855	YB32.2	91258561	3.7	5.133333	625	547.3333	0.038	0.036667	24	22.13333	61.9	47.23333	
			91258434	4.9		531		0.019		14.8		41		
			90478122	6.8		486		0.05		27.6		38.8		
		YB370.3RS	91258444	4	4	265	269	0.048	0.0495	26	26.3	30	30.45	
		YB372.2RS	91258445	4		273		0.051		26.6		30.9		

ALL VALUES = MG/KG

10-32

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

XI. MTCASStat CALCULATIONS & SUMMARY STATISTICS

Calculation of Background Values

This Section contains all of the MTCASStat (MTCASStat is a software package developed for use with Microsoft Excel to meet the need for a fast, simple, integrated method of performing routine statistical analyses described in the statistical *Guidance for Ecology Site Managers*) calculations for 12 elements (Al, As, Be, Cd, Cr, Fe, Hg, Mg, Mn, Ni, Pb, Zn). The 90th percentile value is used by Ecology to calculate natural background values. For more information on how to calculate the 90th percentile, consult the "Statistical Guidance for Site Managers" (August, 1992). A summary of all MTCASStat statistical calculations is presented in Table 17. The statistical distribution maps were prepared using the Statgraphics program.

TABLE 17: BACKGROUND VALUES SUMMARY STATISTICS

ALL VALUES = MG/KG

	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA BASIN	SPOKANE BASIN	GROUP "E"
AI									
MAX	56,550.00	84,900.00	54,550.00	84,900.00	84,900.00	56,550.00	56,550.00	25,850.00	29,000.00
90th	62,905.00	72,561.00	52,276.00	45,735.00	37,206.00	26,259.00	33,379.00	21,376.00	25,591.00
Coeff. Var.	1.20	0.47	0.39	0.63	0.55	0.42	0.38	0.26	0.53
MEAN	25,392.70	20,354.00	34,355.00	25,460.15	21,956.00	18,190.00	22,263.40	15,842.10	15,003.00
MEDIAN	21,700.00	17,900.00	31,192.00	21,760.00	21,956.00	16,600.00	20,800.00	15,000.00	14,800.00
50th	18,748.95	18,376.60	32,446.90	21,899.36	19,277.97	67,234.76	20,892.90	15,380.90	13,525.60
4 X 50th	74,995.80	73,506.40	129,787.60	87,597.44	77,111.88	268,939.04	83,571.60	61,523.60	54,102.40
MIN	5,670.00	7,390.00	13,750.00	5,670.00	5,670.00	6,140.00	10,650.00	8,933.00	6,140.00
As - GFAA ANALYSIS									
MAX	8.99	17.17	6.89	17.168	28.6	28.6	28.6	10.32	7.19
90th	8.47	7.39	5.81	8.37	8.99	7.61	6.13	9.34	5.76
Coeff. Var.	N/A	0.7	0.47	0.58	0.7	0.82	N/A	0.65	0.91
MEAN	3.49	3.96	3.56	3.71	3.82	3.9	3.73	5.02	2.7
MEDIAN	2.8	2.86	3.045	2.91	2.92	2.95	2.64	4.99	2.53
50th	2.80	3.24	3.26	3.19	3.10	3.03	2.64	4.39	2.14
4 X 50th	11.20	12.96	13.04	12.76	12.40	12.12	10.56	17.56	8.56
MIN	1.7	1.45	1.45	1.45	0.5	0.5	0.89	1.13	0.5
Be									
MAX	0.89	0.88	2.16	2.16	2.79	2.79	2.79	0.89	0.88
90th	0.75	0.61	2.07	1.51	1.44	1.27	1.57	0.84	0.61
Coeff. Var.	0.73	0.44	0.35	1.03	0.78	0.50	0.39	0.22	0.45
MEAN	0.39	0.41	1.43	0.75	0.76	0.77	1.03	0.65	0.38
MEDIAN	0.40	0.36	1.48	0.53	0.67	0.72	0.93	0.66	0.31
50th	0.39	0.35	1.43	0.51	0.59	0.70	0.97	0.64	0.35
4 X 50th	1.56	1.40	5.72	2.04	2.36	2.80	3.88	2.56	1.40
MIN	0.10	0.19	0.30	0.10	0.10	0.21	0.39	0.38	0.23
Cd									
MAX	N/A	5.00	1.32	5.00	5.00	1.32	1.32	0.69	N/A
90th	0.40	0.77	0.93	1.20	0.99	0.81	0.93	0.72	N/A
Coeff. Var.	N/A	N/A	0.54	N/A	1.09	0.88	0.54	0.58	N/A
MEAN	N/A	0.80	0.55	0.83	0.63	0.48	0.55	0.40	N/A
MEDIAN	N/A	0.40	0.49	0.83	0.49	0.48	0.49	0.40	N/A
50th	0.10	0.37	0.49	0.40	0.32	0.30	0.49	0.36	N/A
4 X 50th	0.40	1.48	1.96	1.60	1.28	1.20	1.96	1.44	N/A
MIN	N/A	0.10	0.16	0.10	0.10	0.13	0.16	0.13	N/A

TABLE 17: BACKGROUND VALUES SUMMARY STATISTICS

ALL VALUES = MG/KG

	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA BASIN	SPOKANE BASIN	GROUP "E"
Cr									
MAX	163.00	235.00	28.83	235.00	235.00	110.30	110.30	20.25	71.30
90th	75.46	48.15	26.37	47.40	41.88	31.58	38.27	17.61	37.80
Coeff. Var.	0.95	N/A	N/A	N/A	0.70	0.68	N/A	0.36	0.85
MEAN	37.74	30.29	20.64	28.67	23.37	17.67	21.67	11.95	18.92
MEDIAN	26.70	22.00	21.99	22.00	18.42	13.15	16.42	11.78	12.60
50th	28.18	22.00	21.99	22.00	18.69	14.51	16.43	11.43	14.69
4 X 50th	112.72	88.00	87.96	88.00	74.76	58.04	65.72	45.72	58.76
MIN	10.10	12.00	4.42	4.42	2.56	2.55	2.55	4.50	5.00
Cu									
MAX	99.40	243.50	51.71	243.50	243.00	53.00	50.15	29.03	53.00
90th	52.85	38.36	34.43	43.23	36.01	28.40	26.47	21.61	28.42
Coeff. Var.	1.56	N/A	0.42	0.81	0.65	0.46	N/A	0.39	N/A
MEAN	21.24	24.43	22.04	23.15	20.46	17.58	20.16	14.42	17.69
MEDIAN	8.05	15.00	21.78	17.80	17.07	16.30	19.23	14.14	14.70
50th	12.75	15.00	20.49	17.36	16.80	16.22	19.23	14.42	14.70
4 X 50th	51.00	60.00	81.96	69.44	67.20	64.88	76.92	57.68	58.80
MIN	4.33	4.00	9.71	4.00	4.00	4.00	4.13	4.04	9.10
Fe									
MAX	62,800.00	112,500.00	59,850.00	112,500.00	112,500.00	58,800.00	58,880.00	27,000.00	30,000.00
90th	49,170.00	46,126.00	58,665.00	50,125.00	43,106.00	36,644.00	51,451.00	29,026.00	29,631.00
Coeff. Var.	0.72	N/A	0.32	0.62	0.52	0.42	0.51	0.25	0.36
MEAN	25,557.33	21,680.10	40,734.60	28,192.00	25,903.72	23,471.67	29,780.40	18,744.84	19,935.70
MEDIAN	18,200.00	17,050.00	38,508.00	21,433.00	22,033.00	22,116.00	28,821.00	18,150.00	21,300.00
50th	21,446.18	17,050.00	39,180.10	24,152.41	22,987.15	21,810.59	27,689.80	18,276.16	19,027.40
4 X 50th	85,784.72	68,200.00	156,720.40	96,609.64	91,948.60	87,242.36	110,759.20	73,104.64	76,109.60
MIN	9,160.00	5,920.00	16,350.00	5,920.00	5,025.00	5,025.00	5,025.00	9,670.00	10,400.00
Hg									
MAX	0.19	0.09	0.05	0.19	0.19	0.31	0.12	0.13	0.03
90th	0.13	0.07	0.04	0.04	0.07	0.04	0.05	0.02	0.02
Coeff. Var.	1.47	0.44	0.37	0.65		0.96	0.75	N/A	N/A
MEAN	0.05	0.05	0.03	0.04		0.02	0.03	0.02	0.01
MEDIAN	0.04	0.04	0.03	0.04	0.03	0.01	0.02	0.01	0.01
50th	0.03	0.04	0.03	0.04		0.01	0.02	0.01	0.01
4 X 50th	0.12	0.16	0.12	0.16	0.00	0.04	0.08	0.04	0.04
MIN	0.01	0.01	0.05	0.01	0.00	0.00	0.01	0.00	0.00

TABLE 17: BACKGROUND VALUES SUMMARY STATISTICS

ALL VALUES = MG/KG

	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA BASIN	SPOKANE BASIN	GROUP "E"
Mn									
MAX	930.00	2,750.00	1,960.00	2,750.00	2,750.00	1,546.12	1,546.00	769.50	652.00
90th	691.73	1,146.00	1,511.00	1,337.27	1,094.85	636.00	1,164.84	663.48	526.59
Coeff.Var.	0.90	0.61	0.50	0.91	0.69	0.43	0.49	0.23	0.33
MEAN	329.30	592.21	924.20	646.71	592.60	534.40	669.00	506.50	364.95
MEDIAN	231.00	474.00	915.50	531.25	509.58	490.75	589.00	470.00	345.00
50th	257.10	461.62	924.20	494.28	492.82	491.30	611.46	494.78	348.73
4 X 50th	1,028.40	1,846.48	3,696.80	1,977.12	1,971.28	1,965.20	2,445.84	1,979.12	1,394.92
MIN	78.00	90.00	150.00	78.00	78.00	164.45	164.45	354.50	233.00
Ni									
MAX	91.10	244.50	66.75	244.50	244.50	163.00	163.00	18.60	34.10
90th	54.19	38.19	41.04	44.20	38.19	24.44	45.89	16.19	22.41
Coeff.Var.	0.97	N/A	N/A	0.65	0.71	N/A	N/A	0.35	0.48
MEAN	25.66	29.82	17.72	25.44	21.49	17.25	24.83	10.96	13.77
MEDIAN	19.10	23.00	16.23	19.20	16.43	12.50	16.30	10.15	11.70
50th	19.12	23.00	16.23	20.57	16.92	12.40	16.23	10.49	12.54
4 X 50th	76.46	92.00	64.92	82.28	67.68	49.60	64.92	41.96	50.16
MIN	7.60	9.00	7.00	7.00	2.15	2.15	2.15	4.60	6.40
Pb									
MAX	12.00	29.60	207.50	207.50	207.50	17.10	17.10	16.00	11.70
90th	10.87	16.83	24.87	26.42	17.09	13.10	11.90	14.91	9.85
Coeff.Var.	0.72	2.14	0.47	1.42	0.79	0.42	0.24	0.42	0.32
MEAN	5.63	15.90	10.65	11.90	10.05	8.44	11.29	7.00	6.92
MEDIAN	4.00	9.80	6.86	8.20	7.90	7.82	6.53	10.80	6.40
50th	4.75	4.47	9.50	5.92	6.98	7.84	11.01	6.56	6.64
4 X 50th	19.00	17.88	38.00	23.68	27.92	31.36	44.04	26.24	26.56
MIN	2.10	4.65	2.13	2.10	2.10	2.17	2.17	6.75	4.20
Zn									
MAX	116.00	132.50	97.70	132.50	132.50	244.50	101.43	71.00	82.30
90th	85.56	85.06	95.52	98.39	85.82	80.91	78.71	66.40	67.47
Coeff.Var.	0.58	0.50	N/A	0.52	0.41	0.35	0.28	0.21	0.35
MEAN	48.41	51.45	76.01	58.34	55.53	55.55	57.54	51.77	45.74
MEDIAN	44.50	43.65	78.50	54.08	51.12	50.64	52.90	50.90	41.00
50th	42.85	46.52	78.50	52.50	51.56	52.29	55.66	50.83	43.40
4 X 50th	171.40	186.08	314.00	210.00	206.24	209.16	222.64	203.32	173.60
MIN	21.10	12.00	21.40	12.00	12.00	26.30	39.30	29.70	26.30

MTCAS Stat Background Calculations
ALUMINUM DATA

ALUMINUM

STATEWIDE DATA

		<u>Number of samples</u>		<u>Uncensored values</u>		
5670		Uncensored	166	Mean	21,956.67	
6020		Censored	0	Lognormal mean	21,923.33	
6140		TOTAL	166	Std. devn.	12,153.93	
6680				Median	19,575.00	
6930				Min.	5,670.00	
7070				Max.	84,900.00	
7390						
7450						
8130						
8460						
8570						
8933.75						
8970						
9430						
9940						
10360						
10400						
10622.5						
10650						
10713.33						
11600						
11680						
11700						
12050						
12175						
12400						
12462						
12500						
12603.33						
12650						
12850						
12850						
13000						
13100						
13200						
13235						
13500						
13650						
13675						
13700						
13750						
13850						
14150						
14150						
14175						
14550						
14600						
14675						
14800						
14885.71						
14975						
15000						
15066.67						
15100						
15233.33						
15300						
15362.5						
15400						
15450						
15600						
15700						
16366.67						
16400						

MTCASat Background Calculations
ALUMINUM DATA

16450
16500
16540
16600
16700
16900
16900
16975
17000
17000
17100
17450
17900
18750
18750
18900
19160
19300
19353.85
19450
19700
19850
19950
20066.67
20100
20125
20133.33
20150
20500
20536.67
20675
20700
20750
20800
20850
21275
21400
21700
21700
21820
21914.29
21935.71
21950
22350
22400
22450
23000
23100
23192.86
23233.33
23650
23800
24266.67
24400
24550
24800
24800
24900
25100
25300
25500
25600
25700
25850

MTCASat Background Calculations
ALUMINUM DATA

26666.67

26700

26866.67

26900

27200

27800

28800

29000

29600

30250

30300

30984.62

31400

31800

32300

32578.57

32800

33433.33

34450

37800

37850

39300

41400

41800

42766.67

43000

43800

45700

46100

48500

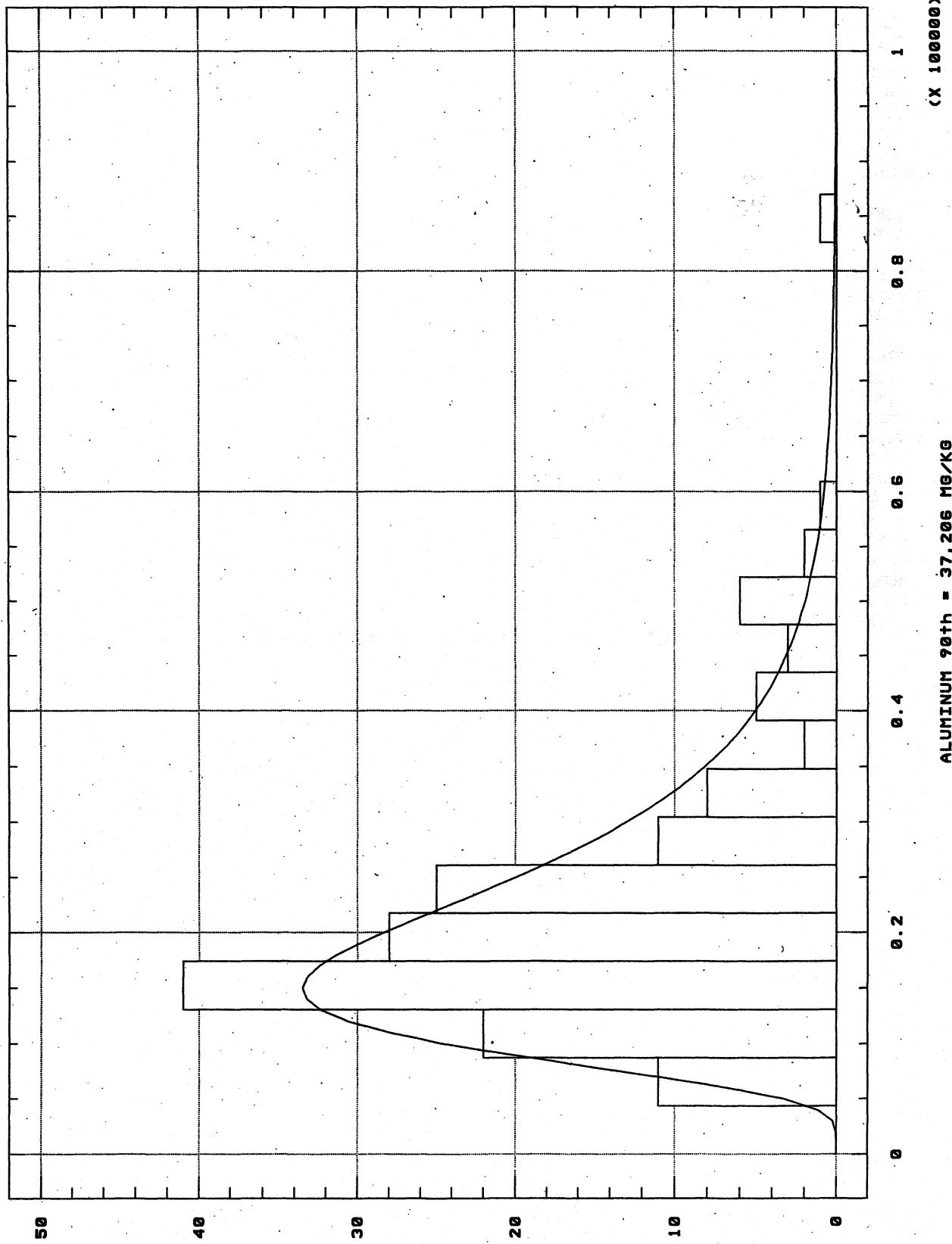
48657.14

48900

50050

50500

STATEWIDE ALUMINUM DISTRIBUTION



Background calculations

5670

6020

6680

7070

7450

16400

16600

21700

25100

28800

37800

46100

50500

51500

53500

AI - GROUP "W"

REGIONS "A", "C", "D"

Number of samples		Uncensored values					
	Uncensored	15	Mean	25392.67			
	Censored	0	Lognormal mean	27100.53			
	TOTAL	15	Std. devn.	18205.86			
			Median	21700			
			Min.	5670			
			Max.	53500			
Lognormal distribution?		Normal distribution?					
r-squared is: 0.91		r-squared is: 0.90					
Recommendations:							
Use lognormal distribution.							
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:				
L		90	62905.87				
L = lognormal			50th 18748.95				
N = normal			4 X 50th 74995.80				
X = neither (so use nonparametric method)							
Coefficient of Variation = 1.2							

MTCASat Background Calculations

13750
19353.85

20150
22350

24400
24800

25500
26700

26866.67
26900

30250
30300

30984.62
31400

33433.33
37850

41800
42766.67

43000
43800

45700
48500

48657.14
48900

50050
54550

AI - CLARK COUNTY

Number of samples	Uncensored values						
Uncensored	26	Mean	34,335.09				
Censored	0	Lognormal mean	34,526.80				
TOTAL	26	Std. devn.	11,296.38				
		Median	31,192.31				
		Min.	13,750.00				
		Max.	54,550.00				
Lognormal distribution?		Normal distribution?					
r-squared is: 0.95		r-squared is: 0.96					
Recommendations:							
Use lognormal distribution.							
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:				
L		90	52,276.91	52276.9099			
L = lognormal		50th	32,446.91	57113.9831			
N = normal		4 X 50th	129,787.65	47439.8367			
X = neither (so use nonparametric method)							
Coefficient of Variation = 0.39							

MTCASat Background Calculations

AI - PUGET SOUND BASIN

7390
10360
10713.33
11600
11680
12175
12400
12462
12850
13200
13675
13700
13850
14150
14175
14975
15233.33
16366.67
16540
16900
17100
17450
17900
18750
19160
20066.67
20125
20500
20675
20800
21400
21700
21820
21935.71
22400
22450
23192.86
23800
24800
31800
32300
32800
34450
39300
84900

Number of samples		Uncensored values					
Uncensored	45	Mean	20,354.90				
Censored	0	Lognormal mean	20,083.46				
TOTAL	45	Std. devn.	12,018.80				
		Median	17,900.00				
		Min.	7,390.00				
		Max.	84,900.00				
Lognormal distribution?		Normal distribution?					
r-squared is: 0.93		r-squared is: 0.62					
Recommendations:							
Use lognormal distribution.							
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:				
L		90	32,581.66	32581.6593			
L = lognormal		50th	18,376.61	35406.1544			
N = normal		4 X 50th	73,506.44	29757.1642			
Coefficient of Variation = 0.47							

MTCASat Background Calculations

AI - YAKIMA BASIN

10650					
11700					
13500					
14600					
14885.71					
15300	Number of samples				
15450	Uncensored	32	Mean 22263.39		
15600	Censored	0	Lognormal mean 22211.65		
16450	TOTAL	32	Std. devn. 8991.12		
16900			Median 20800		
17000			Min. 10650		
18750			Max. 56550		
19300	Lognormal distribution?	Normal distribution?			
19700					
20133.33	r-squared is: 0.97	r-squared is: 0.82			
20750					
20850	Recommendations:				
21914.29					
21950					
23000					
23233.33	Use lognormal distribution.				
24266.67					
24550					
24900					
25300					
26666.67	Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:		
27200	L	90	33379.65		
27800	L = lognormal	50th	20892.85		
29600	N = normal	4 X 50th	83571.39		
32578.57	X = neither (so use nonparametric method)	Coefficient of Variation = 0.38			
41400					
56550					

MTCAS Stat Background Calculations

AI - SPOKANE BASIN

8933.75
10622.5
12050
12500
12603.33
12650
12850
13100
13235
13650
14150
14550
14675
15000
15066.67
15362.5
15700
16500
16975
17000
19450
19850
19950
20536.67
21275
23650
25850

Number of samples		<u>Uncensored values</u>					
Uncensored	27	Mean	15,842.05				
Censored	0	Lognormal mean	15,854.55				
TOTAL	27	Std. devn.	4,011.60				
		Median	15,000.00				
		Min.	8,933.75				
		Max.	25,850.00				
Lognormal distribution?		Normal distribution?					
r-squared is: 0.98		r-squared is: 0.94					
Recommendations:							
Use lognormal distribution.							
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:				
L		90	21,376.01	21376.0061			
L = lognormal		50th 15,380.88 22749.6662					
N = normal		4 X 50th 61,523.50 20002.3461					
X = neither (so use nonparametric method)							
Coefficient of Variation = 0.26							

MTCASStat Background Calculations

AI - GROUP "E"

REGIONS "J","L","P","R"

6140
6930
8130
8460
8570
8970
9430
9940
10400
13000
14800
15100
15400
16700
18900
20100
20700
23100
25600
25700
29000

Number of samples		<u>Uncensored values</u>					
	Uncensored	21	Mean	15,003.33			
	Censored	0	Lognormal mean	15,114.02			
	TOTAL	21	Std. devn.	6,922.27			
			Median	14,800.00			
			Min.	6,140.00			
			Max.	29,000.00			
Lognormal distribution?		Normal distribution?					
r-squared is: 0.96		r-squared is: 0.94					
Recommendations:							
Use lognormal distribution.							
Enter distribution (L, N or X)		Enter percentile		Value corresponding to that percentile is:			
L		90		25,591.95 25591.9465			
L = lognormal		50th		13,525.62 27971.4051			
N = normal		4 X 50th		54,102.46 23212.4879			
Coefficient of Variation = 0.53							

MTCASStat Background Calculations **ARSENIC DATA**

ARSENIC

STATEWIDE DATA

DATA BASED ON GRAPHITE FURNACE ATOMIC ABSORPTION (GFAA) ANALYSIS

Number of samples		Uncensored values					
Uncensored	142		Mean	3.82			
Censored	0		Lognormal mean	3.77			
TOTAL	142		Std. devn.	3.15			
			Median	2.92			
			Min.	0.50			
			Max.	28.60			
Lognormal distribution?		Normal distribution?					
r-squared is: 0.98		r-squared is: 0.64					
Recommendations:							
Use lognormal distribution.							
Enter distribution (L, N or X)		Enter percentile		Value corresponding to that percentile is:			
L		90		6.99 6.9938			
N = normal		50th		3.10 7.2116			
X = neither (so use nonparametric method)		4 X 50th		12.41 6.7760			
Coefficient of Variation = 0.7							

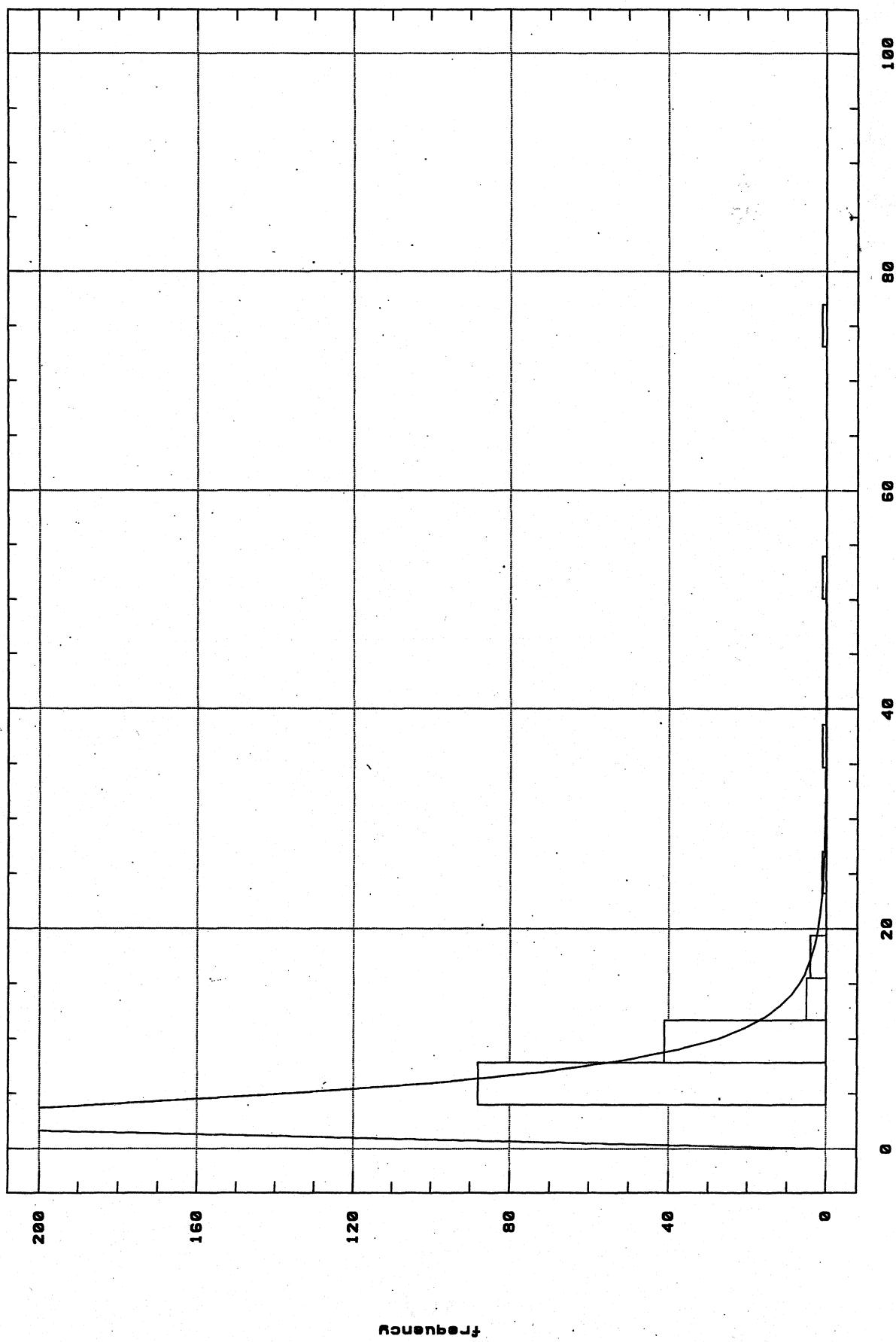
MTCASat Background Calculations
ARSENIC DATA

2.8
2.815
2.83
2.86
2.9
2.9
2.9
2.913333
2.916667
2.935
2.99
2.995
2.995
3.01
3.065
3.08
3.3
3.42
3.45
3.475
3.48
3.485
3.53
3.57
3.57
3.645
3.65
3.67
3.73
3.735
3.796
3.819286
3.862
4.0275
4.1
4.115
4.203333
4.215
4.25
4.274286
4.305
4.326
4.39
4.42
4.55
4.65
4.82
4.995
5.113333
5.16
5.195
5.26
5.28
5.415
5.54
5.55
5.583
5.585
5.818
6.034
6.12
6.41
6.453333
6.89

MTCASat Background Calculations
ARSENIC DATA

6.9275
7.19
7.625714
7.9475
8.01
8.12
8.42
8.53
8.615
8.635
8.99
9.397857
10.32571
17.16846
28.6

STATEWIDE ARSENIC DISTRIBUTION



MTCASat Background Calculations

As - GROUP "W"

**DATA BASED ON GRAPHITE FURNACE ATOMIC ABSORPTION (GFAA) ANALYSIS
WESTERN WASHINGTON, REGIONS A,C,D**

Number of samples		<u>Uncensored values</u>			
Uncensored	15	Mean	3.49		
Censored	0	Lognormal mean	3.46		
TOTAL	15	Std. devn.	2.26		
		Median	2.8		
		Min.	1.7		
		Max.	8.99		
Lognormal distribution?		Normal distribution?			
r-squared is: 0.89		r-squared is: 0.75			
Recommendations:					
Use nonparametric method.					
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:			
X	90	8.47			
L = lognormal	50th	2.80			
N = normal	4 X 50th	11.20			
X = neither (so use nonparametric method)	Coefficient of Variation = N/A				

MTCAS Stat Background Calculations

1.45
1.5
2
2.12
2.15
2.65
2.8
2.9
2.913333
2.995
3.01
3.08
3.42
3.67
3.796
4.115
4.42
5.195
5.54
5.583
6.034
6.89

As - CLARK COUNTY
DATA BASED ON GRAPHITE FURNACE ATOMIC ABSORPTION (GFAA) ANALYSIS

Number of samples		Uncensored values			
Uncensored	22	Mean	3.56		
Censored	0	Lognormal mean	3.58		
TOTAL	22	Std. devn.	1.50		
		Median	3.045		
		Min.	1.45		
		Max.	6.89		
Lognormal distribution?		Normal distribution?			
r-squared is: 0.98		r-squared is: 0.94			
Recommendations:					
Use lognormal distribution.					
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:			
L	90	5.81			
L = lognormal	50th	3.26			
N = normal	4 X 50th	13.05			
X = neither (so use nonparametric method)	Coefficient of Variation = 0.47				

MTCASat Background Calculations

1.45
1.616667
1.665
1.8
1.975
1.993333
2.145
2.15
2.215
2.3
2.35
2.535
2.83
2.86
2.935
2.99
3.735
3.819286
4.215
4.25
4.274286
4.326
5.585
5.818
8.615
9.397857
17.16846

As - PUGET SOUND BASIN
DATA BASED ON GRAPHITE FURNACE ATOMIC ABSORPTION (GFAA) ANALYSIS

Number of samples	<u>Uncensored values</u>			
Uncensored	27	Mean	3.96	
Censored	0	Lognormal mean	3.85	
TOTAL	27	Std. devn.	3.30	
		Median	2.86	
		Min.	1.45	
		Max.	17.1684615	
Lognormal distribution?		Normal distribution?		
	r-squared is: 0.92		r-squared is: 0.65	
Recommendations:	Use lognormal distribution.			
GFAA ANALYSIS				
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:		
L	90	7.30		
L = lognormal	50th	3.24		
N = normal	4 X 50th	12.94		
X = neither (so use nonparametric method)	Coefficient of Variation = 0.7			

MTCASStat Background Calculations

0.89
0.96
1.245
1.3875
1.715
1.8
1.8
1.814286
1.95
2.286667
2.3
2.43
2.5
2.5
2.58
2.706667
2.815
2.916667
2.995
3.065
3.475
3.53
3.57
3.862
4.203333
4.39
4.82
5.16
7.625714
28.6

As - YAKIMA BASIN

DATA BASED ON GRAPHITE FURNACE ATOMIC ABSORPTION (GFAA) ANALYSIS

Number of samples		<u>Uncensored values</u>							
	Uncensored	30	Mean	3.73					
	Censored	0	Lognormal mean	3.44					
	TOTAL	30	Std. devn.	4.90					
			Median	2.64333333					
			Min.	0.89					
			Max.	28.6					
Lognormal distribution?		Normal distribution?							
r-squared is: 0.88		r-squared is: 0.39							
Recommendations:									
Use nonparametric method.									
Enter distribution (L, N or X)		Enter percentile		Value corresponding to that percentile is:					
X		90		5.13					
L = lognormal		50th		2.64					
N = normal		4 X 50th		10.57					
X = neither (so use nonparametric method)									
Coefficient of Variation = N/A									

MTCAS Stat Background Calculations

1.136667
1.45
2.3
2.515
2.55
2.74
2.75
3.3
3.45
3.485
3.645
4.0275
4.305
4.995
5.113333
5.26
5.415
5.55
6.41
6.453333
6.9275
7.9475
8.01
8.42
8.53
8.635
10.32571

As - SPOKANE BASIN

DATA BASED ON GRAPHITE FURNACE ATOMIC ABSORPTION (GFAA) ANALYSIS

Number of samples		Uncensored values			
Uncensored	27	Mean	5.02		
Censored	0	Lognormal mean	5.13		
TOTAL	27	Std. devn.	2.48		
		Median	4.995		
		Min.	1.13666667		
		Max.	10.3257143		
Lognormal distribution?		Normal distribution?			
r-squared is: 0.96		r-squared is: 0.96			
Recommendations:					
Use lognormal distribution.					
Enter distribution (L, N or X)		Value corresponding to that percentile is:			
L		Enter percentile 90			
L = lognormal		9.34			
N = normal		50th 4 X 50th			
X = neither (so use nonparametric method)		4.39 17.54			
Coefficient of Variation = 0.65					

MTCASStat Background Calculations

As - GROUP "E"

**DATA BASED ON GRAPHITE FURNACE ATOMIC ABSORPTION (GFAA) ANALYSIS
EASTERN WASHINGTON, REGIONS J,L,P,R**

Number of samples		<u>Uncensored values</u>			
	Uncensored	21	Mean 2.70		
	Censored	0	Lognormal mean 2.80		
	TOTAL	21	Std. devn. 1.83		
			Median 2.53		
			Min. 0.5		
			Max. 7.19		
Lognormal distribution?		Normal distribution?			
r-squared is: 0.97		r-squared is: 0.91			
Recommendations:					
Use lognormal distribution.					
Enter distribution (L, N or X)		Enter percentile			
L		Value corresponding to that percentile is:			
L = lognormal		90 5.76			
N = normal		50th 2.14			
X = neither (so use nonparametric method)		4 X 50th 8.54			
Coefficient of Variation = 0.91					

MTCASStat Background Calculations
BERYLLIUM DATA

BERYLLIUM

STATEWIDE DATA

Number of samples	<u>Uncensored values</u>						
	Uncensored	157	Mean	0.76			
	Censored	8	Lognormal mean	0.77			
	TOTAL	165	Std. devn.	0.49			
			Median	0.67			
			Min.	0.10			
			Max.	2.79			
Lognormal distribution?		Normal distribution?					
r-squared is: 0.98		r-squared is: 0.88					
Recommendations:							
Use lognormal distribution.							
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:					
L	90	1.44	1.4373				
L = lognormal	50th	0.59	1.6116				
N = normal	4 X 50th	2.37	1.2629				
X = neither (so use nonparametric method)	Coefficient of Variation = 0.78						

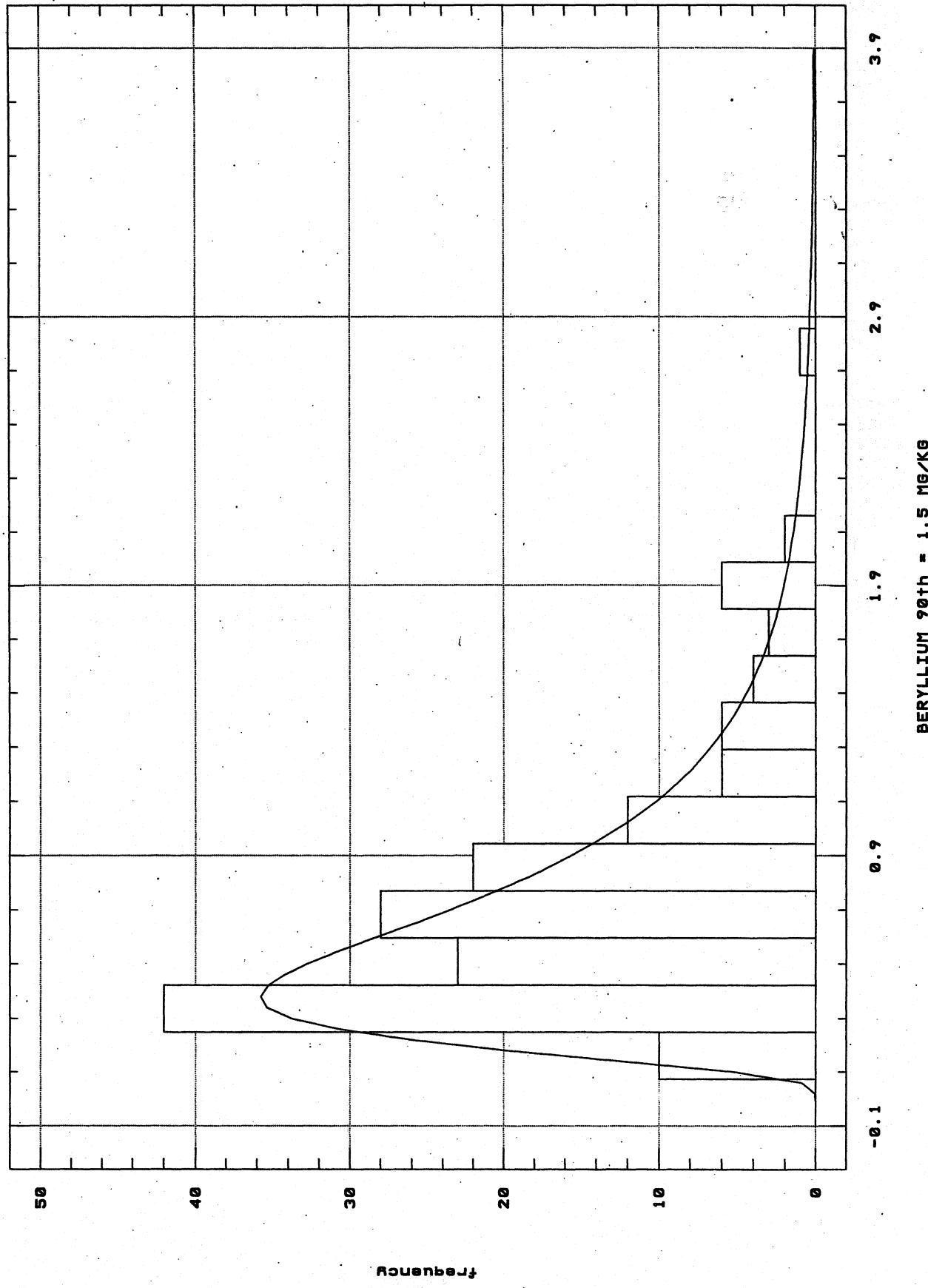
MTCASat Background Calculations
BERYLLIUM DATA

0.53
0.53
0.535
0.54
0.54
0.544
0.55
0.58
0.58
0.58
0.585
0.586667
0.6
0.605
0.61
0.61
0.62625
0.635
0.636429
0.65
0.65
0.655
0.663333
0.665
0.6675
0.67
0.6825
0.7
0.7
0.7
0.7
0.71
0.71
0.72
0.72
0.723333
0.73
0.75
0.75
0.75
0.77
0.77
0.77
0.78
0.785
0.79
0.805
0.815
0.82
0.82
0.82
0.825
0.83
0.84
0.875
0.875
0.89
0.89
0.89
0.89
0.905
0.920714
0.95
0.98

MTCASStat Background Calculations
BERYLLIUM DATA

1
1.02
1.030769
1.036667
1.044286
1.046667
1.075714
1.085
1.09
1.11
1.135
1.14
1.15
1.156667
1.21
1.245
1.31
1.335
1.36
1.38
1.4175
1.45
1.475
1.483333
1.483846
1.636667
1.723333
1.743333
1.79
1.815
1.87
1.92
1.94
1.955

STATEWIDE BERYLLIUM DISTRIBUTION



MTCASat Background Calculations

0.1
0.1
0.1
0.1
0.13
0.26
0.29
0.4
0.44
0.46
0.6
0.61
0.65
0.71
0.89

Be - GROUP "W"

REGIONS A,C,D - WESTERN WASHINGTON

Number of samples	<u>Uncensored values</u>							
	Uncensored	15	Mean	0.39				
	Censored	0	Lognormal mean	0.42				
	TOTAL	15	Std. devn.	0.26				
			Median	0.4				
			Min.	0.1				
			Max.	0.89				
Lognormal distribution?			Normal distribution?					
r-squared is: 0.89			r-squared is: 0.93					
Recommendations:								
Use normal distribution.								
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:					
N		90	0.75					
L = lognormal		50th	0.39					
N = normal		4 X 50th	1.56					
Coefficient of Variation = 0.73								

MTCASat Background Calculations

0.305
0.585
0.75
1
1.02
1.030769
1.09
1.11
1.135
1.335
1.36
1.45
1.475
1.483333
1.483846
1.636667
1.723333
1.743333
1.79
1.815
1.87
1.92
1.94
1.955
1.99
2.155714

Be - CLARK COUNTY

Number of samples		<u>Uncensored values</u>					
	Uncensored	26	Mean	1.43			
	Censored	0	Lognormal mean	1.46			
	TOTAL	26	Std. devn.	0.47			
			Median	1.47916667			
			Min.	0.305			
			Max.	2.15571429			
Lognormal distribution?		Normal distribution?					
r-squared is: 0.83		r-squared is: 0.96					
Recommendations:							
Use normal distribution.							
Enter distribution (L, N or X)	N	Enter percentile	Value corresponding to that percentile is:				
L = lognormal		90	2.07				
N = normal			50th	1.43			
X = neither (so use nonparametric method)			4 X 50th	5.72			
Coefficient of Variation = 0.35							

MTCASat Background Calculations

B_e - PUGET SOUND BASIN

0.185
0.23
0.23
0.243333
<0.5
<0.5
<0.5
<0.5
<0.5
<0.5
<0.5
0.253333
0.256667
0.266154
0.27
0.27
0.291429
0.296667
<0.6
0.305
0.3125
0.32
0.3225
0.33
0.333333
0.35
0.366667
0.37
0.37
0.375
0.395
0.41
0.415
0.47
0.53
0.53
0.544
0.61
0.665
0.7
0.7
0.7
0.75
0.875

Number of samples		<u>Uncensored values</u>					
	Uncensored	36	Mean	0.41			
	Censored	8	Lognormal mean	0.41			
	TOTAL	44	Std. devn.	0.18			
			Median	0.35833333			
			Min.	0.185			
			Max.	0.875			
Lognormal distribution?		Normal distribution?					
r-squared is: 0.91		r-squared is: 0.82					
Recommendations:							
Use lognormal distribution.							
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:				
L		90	0.61				
L = lognormal			50th 0.35				
N = normal			4 X 50th 1.40				
X = neither (so use nonparametric method)			Coefficient of Variation = 0.44				

MTCASStat Background Calculations

Be - YAKIMA BASIN

0.39
0.635
0.65
0.7
0.72
0.73
0.77
0.78
0.805
0.815
0.82
0.83
0.89
0.89
0.905
0.920714
0.95
0.98
1.036667
1.044286
1.046667
1.075714
1.085
1.15
1.156667
1.21
1.245
1.31
1.38
1.4175
1.97
2.79

Number of samples		<u>Uncensored values</u>					
	Uncensored	32	Mean	1.03			
	Censored	0	Lognormal mean	1.03			
	TOTAL	32	Std. devn.	0.43			
			Median	0.93535714			
			Min.	0.39			
			Max.	2.79			
Lognormal distribution?		Normal distribution?					
r-squared is: 0.93		r-squared is: 0.76					
Recommendations:							
Use lognormal distribution.							
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:				
L		90	1.57				
L = lognormal		50th	0.97				
N = normal		4 X 50th	3.88				
X = neither (so use nonparametric method)		Coefficient of Variation = 0.39					

MTCASat Background Calculations

Be - SPOKANE BASIN

0.3775
 0.476667
 0.495
 0.505
 0.515
 0.535
 0.54
 0.55
 0.58
 0.586667
 0.605
 0.62625
 0.636429
 0.655
 0.663333
 0.6675
 0.67
 0.6825
 0.72
 0.723333
 0.75
 0.785
 0.82
 0.82
 0.825
 0.875
 0.89

Number of samples		Uncensored values			
Uncensored	27	Mean	0.65		
Censored	0	Lognormal mean	0.65		
TOTAL	27	Std. devn.	0.13		
		Median	0.655		
		Min.	0.3775		
		Max.	0.89		
Lognormal distribution?		Normal distribution?			
r-squared is: 0.97		r-squared is: 0.98			
Recommendations:					
Use lognormal distribution.					
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:			
L	90	0.84			
L = lognormal	50th	0.64			
N = normal	4 X 50th	2.55			
X = neither (so use nonparametric method)	Coefficient of Variation = 0.22				

MTCASat Background Calculations

0.23
0.23
0.243333
0.253333
0.256667
0.266154
0.27
0.296667
0.305
0.3225
0.366667
0.41
0.415
0.47
0.544
0.665
0.875

Be - GROUP "E"

REGIONS J,L,P,R - EASTERN WASHINGTON

Number of samples		Uncensored values			
Uncensored	17	Mean	0.38		
Censored	0	Lognormal mean	0.38		
TOTAL	17	Std. devn.	0.18		
		Median	0.305		
		Min.	0.23		
		Max.	0.875		
Lognormal distribution?		Normal distribution?			
r-squared is: 0.90		r-squared is: 0.79			
Recommendations:					
Use lognormal distribution.					
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:			
L	90	0.61			
L = lognormal	50th	0.35			
N = normal	4 X 50th	1.39			
X = neither (so use nonparametric method)	Coefficient of Variation = 0.45				

MTCAS Stat Background Calculations
CADMUM DATA

CADMUM
STATEWIDE DATA

Number of samples	Uncensored values									
	Uncensored	104	Mean	0.63						
Censored	61		Lognormal mean	0.62						
TOTAL	165		Std. devn.	0.58						
			Median	0.49						
			Min.	0.10						
			Max.	5.00						
Lognormal distribution?	Normal distribution?									
	r-squared is: 0.91									
Recommendations:										
Use lognormal distribution.										
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:								
L	90	0.99	0.9895							
L = lognormal	50th	0.32	1.4052							
N = normal	4 X 50th	1.27	0.5738							
X = neither (so use nonparametric method)	Coefficient of Variation = 1.09									

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<0.2

0.125

0.125

0.14

0.155

0.155

0.155

0.18

0.185

0.185

0.19

0.2

0.215

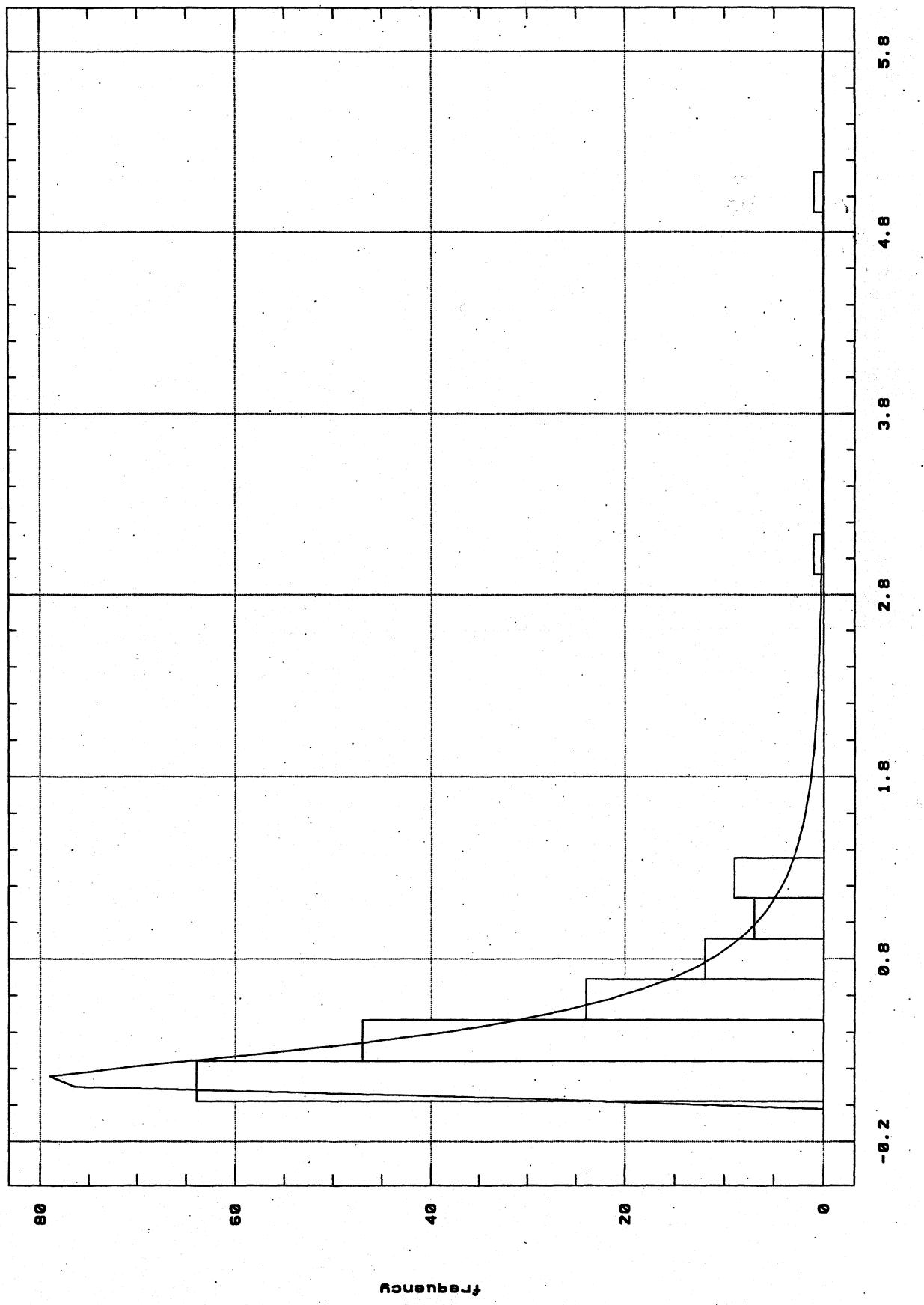
MTCASat Background Calculations
CADMUM DATA

0.215
0.26
0.275
0.28
0.303333
0.3125
0.32
0.33
0.338571
0.34
0.34
0.35
0.35
0.36
0.365
0.365714
0.37
0.37
0.37
0.375
0.38
0.395
0.4
0.4
0.4
0.4
<0.8
<0.8
<0.8
<0.8
<0.8
<0.8
<0.8
<0.8
<0.8
<0.8
<0.8
0.405
0.41
0.42
0.424
0.445
0.45
0.453333
0.458462
0.46
0.4625
0.465
0.483333
0.485
0.500714
0.505
0.515
0.525
0.535
0.535
0.54
0.566667
0.57
0.61
0.62
0.626667
0.629286
0.63

MTCASat Background Calculations
CADMUM DATA

0.645
0.653333
0.66
0.665
0.665714
0.676667
0.676667
0.685
0.7
0.7
0.705
0.715
0.72
0.74
0.8
0.805
0.831429
0.836667
0.8425
0.87
0.92
0.937692
0.955385
0.97
1.06
1.06
1.1
1.2
1.2
1.225
1.225
1.25
1.275
1.294286

STATEWIDE CADMIUM DISTRIBUTION



MTCAS Stat Background Calculations

Cd - GROUP "W"

REGIONS A,C,D - WESTERN WASHINGTON

Number of samples		<u>Uncensored values</u>			
Uncensored	0	Mean	N/A		
Censored	14	Lognormal mean	N/A		
TOTAL	14	Std. devn.	N/A		
		Median	N/A		
		Min.	N/A		
		Max.	N/A		
Lognormal distribution?		Normal distribution?			
r-squared is:		r-squared is:			
Recommendations:					
Review of data needed for background decision.					
Enter distribution (L, N or X)		Value corresponding to that percentile is:			
L		Enter percentile			
L = lognormal		90			
N = normal		50th			
X = neither (so use nonparametric method)		4 X 50th			
		Coefficient of Variation = N/A			

MTCAStat Background Calculations

Cd - CLARK COUNTY

0.155
0.42
0.445
0.485
0.505
0.535
0.62
0.7
0.705
0.715
0.74
0.805
0.836667
0.92
0.937692
0.955385
0.97
1.06
1.06
1.1
1.2
1.225
1.225
1.25
1.294286
1.3

Number of samples		Uncensored values
Uncensored	32	Mean 0.55
Censored	0	Lognormal mean 0.55
TOTAL	32	Std. devn. 0.27
		Median 0.49202381
		Min. 0.155
		Max. 1.32857143
Lognormal distribution?		Normal distribution?
r-squared is: 0.98		r-squared is: 0.89
Recommendations:		
Use lognormal distribution.		
Enter distribution (L, N or X)		Value corresponding to that percentile is:
L		90 0.93
L = lognormal		50th 0.49
N = normal		4 X 50th 1.95
X = neither (so use nonparametric method)		Coefficient of Variation = 0.54

MTCASat Background Calculations

Cd - PUGET SOUND BASIN

Number of samples	Uncensored values						
Uncensored	19	Mean	0.80				
Censored	25	Lognormal mean	0.73				
TOTAL	44	Std. devn.	1.20				
		Median	0.4				
		Min.	0.1				
		Max.	5				
Lognormal distribution?		Normal distribution?					
r-squared is: 0.81		r-squared is: 0.45					
Recommendations:							
More than half the data are censored. Nonparametric method recommended.							
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:				
X		90	0.77				
L = lognormal		50th	0.37				
N = normal		4 X 50th	1.49				
Coefficient of Variation = N/A							

MTCASat Background Calculations

0.155
0.185
0.26
0.275
0.32
0.33
0.35
0.35
0.365
0.37
0.37
0.4
0.405
0.45
0.46
0.483333
0.500714
0.515
0.525
0.61
0.629286
0.63
0.66
0.665
0.665714
0.676667
0.72
0.8
0.8425
0.87
1.275
1.328571

Cd - YAKIMA BASIN

Number of samples		<u>Uncensored values</u>			
Uncensored	32	Mean	0.55		
Censored	0	Lognormal mean	0.55		
TOTAL	32	Std. devn.	0.27		
		Median	0.49202381		
		Min.	0.155		
		Max.	1.32857143		
Lognormal distribution?		Normal distribution?			
r-squared is: 0.98		r-squared is: 0.89			
Recommendations:					
Use lognormal distribution.					
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:		
L		90	0.93		
L = lognormal		50th	0.49		
N = normal		4 X 50th	1.95		
X = neither (so use nonparametric method)		Coefficient of Variation = 0.54			

Background calculations

Cd - SPOKANE BASIN

0.125
0.125
0.18
0.185
0.2
0.215
0.215
0.3125
0.338571
0.34
0.36
0.37
0.375
0.395
0.4
0.41
0.453333
0.4625
0.465
0.535
0.54
0.57
0.626667
0.645
0.653333
0.676667
0.685

Number of samples	<u>Uncensored values</u>							
	Uncensored	27	Mean	0.40				
	Censored	0	Lognormal mean	0.41				
	TOTAL	27	Std. devn.	0.17				
			Median	0.395				
			Min..	0.125				
			Max.	0.685				
Lognormal distribution?			Normal distribution?					
r-squared is: 0.93			r-squared is: 0.96					
Recommendations:								
Use lognormal distribution.								
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:					
L		90	0.72					
L = lognormal		50th	0.36					
N = normal		4 X 50th	1.44					
Coefficient of Variation = 0.58								

Background calculations

Cd - GROUP "E"

REGIONS "J", "L", "P", "R" - EASTERN WASHINGTON

Number of samples		Uncensored values	
Uncensored	0	Mean	N/A
Censored	21	Lognormal mean	N/A
TOTAL	21	Std. devn.	N/A
		Median	N/A
		Min.	N/A
		Max.	N/A
Lognormal distribution?		Normal distribution?	
r-squared is:		r-squared is:	
Recommendations:			
Review of data needed for background decision.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L		Enter percentile	N/A
L = lognormal		90	50th N/A
N = normal		4 X 50th N/A	
X = neither (so use nonparametric method)		Coefficient of Variation = N/A	

MTACASStat Background Calculations
CHROMIUM DATA

CHROMIUM

STATEWIDE

Number of samples		<u>Uncensored values</u>					
Uncensored	166	Mean	23.37				
Censored	0	Lognormal mean	22.51				
TOTAL	166	Std. devn.	24.10				
		Median	18.42				
		Min.	2.56				
		Max.	235.00				
Lognormal distribution?		Normal distribution?					
r-squared is: 0.95		r-squared is: 0.48					
Recommendations:							
Use lognormal distribution.							
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:				
L		90	41.88	0.0000			
L = lognormal		50th	18.69	0.0000			
N = normal		4 X 50th	74.76	0.0000			
X = neither (so use nonparametric method)							
Coefficient of Variation = 0.7							

2.555

4.425

4.5

5

6.1

6.31

6.5675

6.6

7.6

7.67

8.44

8.8

8.953333

9.1

9.11

9.235

9.94

10.1

10.535

10.65

10.8

10.8

10.97667

11.05333

11.4

11.4

11.45

11.6

11.6

11.65

11.73333

11.78857

11.85

12

12.00286

12.03333

12.135

12.2

12.3375

12.6

12.7

12.85

12.96

13.025

13.05

13.15

13.15714

13.25

13.3

14.25

14.3

14.3

14.4

14.65

14.8

15

15.4

15.55

15.85

16

16

16.1

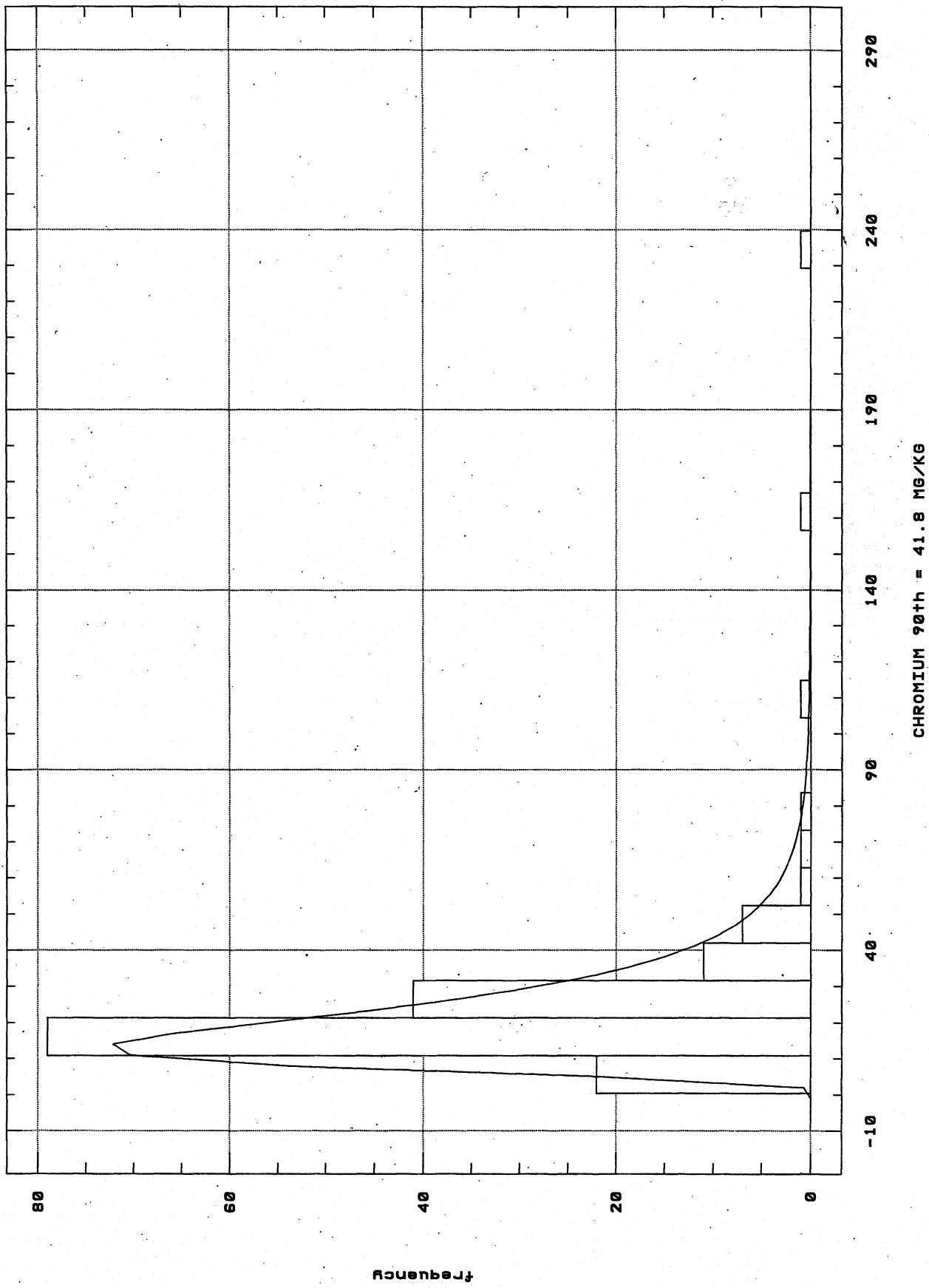
MTACASat Background Calculations
CHROMIUM DATA

16.35
16.36667
16.385
16.45
16.5
16.7
16.75
16.8
16.95
17.15
17.55
17.9
17.95
18.05
18.1
18.1
18.22857
18.3
18.3
18.34286
18.5
18.63333
18.74286
18.75
18.775
19
19
19
19.5
19.92
19.95
20
20
20.25
20.25
20.66667
20.95
21.15
21.225
21.23333
21.5
21.7
21.7
21.91538
22
22
22
22
22.06667
22.2
22.5
22.6
22.625
23
23.11538
23.2
23.26667
23.37143
23.825
23.96667
24
24
24.35
24.35385

MTACASat Background Calculations
CHROMIUM DATA

24.4
24.9
25.1
25.7
26
26.23333
26.7
27.35
28.2
28.83333
29.3
30.3
31.3
31.46667
• 31.6
32
33.225
34.2
35.3
35.9
36.9
37.85
38.4
38.45
41.2
41.95
45.2
46.02857
47.25
47.75
48.75
49.12143
51.5
56.7

STATEWIDE CHROMIUM DISTRIBUTION



MTCASStat Background Calculations

10.1
11.4
12.2
14.8
16
25.1
26
26.7
32
34.2
41.2
45.2
51.5
56.7
163

Cr - GROUP "W"

REGIONS A,C,D - WESTERN WASHINGTON

Number of samples		Uncensored values					
	Uncensored	15	Mean	37.74			
	Censored	0	Lognormal mean	37.08			
	TOTAL	15	Std. devn.	37.68			
			Median	26.7			
			Min.	10.1			
			Max.	163			
Lognormal distribution?		Normal distribution?					
r-squared is: 0.94		r-squared is: 0.62					
Recommendations:							
Use lognormal distribution.							
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:				
L		90	78.46				
L = lognormal		50th	28.18				
N = normal		4 X 50th	112.73				
X = neither (so use nonparametric method)							
Coefficient of Variation = 0.95							

MTCASat Background Calculations

4.425
8.44
14.65
16.45
16.75
18.05
18.1
18.1
18.3
18.75
20.95
21.7
21.91538
22.06667
23.11538
23.2
23.26667
23.37143
23.825
23.96667
24.35
24.9
25.7
26.23333
27.35
28.83333

Cr - CLARK COUNTY

Number of samples		Uncensored values					
Uncensored	26	Mean	20.64				
Censored	0	Lognormal mean	21.09				
TOTAL	26	Std. devn.	5.52				
		Median	21.9910256				
		Min.	4.425				
		Max.	28.8333333				
Lognormal distribution?		Normal distribution?					
r-squared is: 0.69		r-squared is: 0.89					
Recommendations:							
Use nonparametric method.							
Enter distribution (L, N or X)	X	Enter percentile	Value corresponding to that percentile is:				
L = lognormal		90	26.57				
N = normal		50th	21.99				
X = neither (so use nonparametric method)		4 X 50th	87.96				
Coefficient of Variation = N/A							

MTCASat Background Calculations

Cr - PUGET SOUND BASIN

Number of samples	Uncensored values	
Uncensored	Mean 30.29	
Censored	Lognormal mean 28.28	
TOTAL	Std. devn. 33.54	
	Median 22	
	Min. 12	
	Max. 235	
Lognormal distribution?	Normal distribution?	
r-squared is: 0.75	r-squared is: 0.36	
Recommendations:	Use nonparametric method.	
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:
X	90	48.15
L = lognormal	50th	22.00
N = normal	4 X 50th	88.00
X = neither (so use nonparametric method)	Coefficient of Variation = N/A	

MTCASat Background Calculations

2.555
7.67
11.6
11.73333
12.00286
12.135
12.96
13.15
13.15714
13.3
14.3
14.3
15
15.55
15.85
16.35
16.5
16.7
16.8
17.15
18.22857
18.5
18.63333
21.23333
22
30.3
31.46667
31.6
37.85
38.45
46.02857
110.3

Cr - YAKIMA BASIN

Number of samples		Uncensored values					
	Uncensored	32	Mean	21.67			
	Censored	0	Lognormal mean	21.41			
	TOTAL	32	Std. devn.	18.73			
			Median	16.425			
			Min.	2.555			
			Max.	110.3			
Lognormal distribution?		Normal distribution?					
r-squared is: 0.87		r-squared is: 0.57					
Recommendations:							
Use nonparametric method.							
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:				
X		90	38.27				
L = lognormal			50th 16.43				
N = normal			4 X 50th 65.70				
X = neither (so use nonparametric method)			Coefficient of Variation = N/A				

MTCASStat Background Calculations

Cr - SPOKANE BASIN

4.5
6.31
6.5675
8.953333
9.235
9.94
10.535
10.65
10.97667
11.05333
11.45
11.6
11.65
11.78857
11.85
12.03333
12.3375
12.7
12.85
13.025
13.05
13.25
14.4
16
16.95
18.775
20.25

Number of samples		Uncensored values					
Uncensored	27	Mean	11.95				
Censored	0	Lognormal mean	12.02				
TOTAL	27	Std. devn.	3.46				
		Median	11.7885714				
		Min.	4.5				
		Max.	20.25				
Lognormal distribution?		Normal distribution?					
r-squared is: 0.90		r-squared is: 0.95					
Recommendations:							
Use lognormal distribution.							
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:				
L		90	17.81				
L = lognormal			50th 11.43				
N = normal			4 X 50th 45.70				
X = neither (so use nonparametric method)							
Coefficient of Variation = 0.36							

MTCASStat Background Calculations

5
6.1
6.6
7.6
8.8
9.1
9.11
10.8
10.8
11.4
12.6
15.4
16.1
17.9
18.3
20
29.3
35.9
36.9
38.4
71.3

Cr - GROUP "E"

REGIONS J,L,P,R - EASTERN WASHINGTON

Number of samples	<u>Uncensored values</u>						
Uncensored	21	Mean	18.92				
Censored	0	Lognormal mean	18.74				
TOTAL	21	Std. devn.	15.85				
		Median	12.6				
		Min.	5				
		Max.	71.3				
Lognormal distribution?		Normal distribution?					
r-squared is: 0.96		r-squared is: 0.75					
Recommendations:							
Use lognormal distribution.							
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:				
L		90	37.80				
L = lognormal		50th	14.69				
N = normal		4 X 50th	58.77				
X = neither (so use nonparametric method)		Coefficient of Variation = 0.85					

MTCATStat Background Calculations
COPPER DATA

COPPER

STATEWIDE

Number of samples		<u>Uncensored values</u>					
Uncensored	166	Mean	20.46				
Censored	0	Lognormal mean	19.75				
TOTAL	166	Std. devn.	21.37				
		Median	17.07				
		Min.	4.00				
		Max.	243.50				
Lognormal distribution?		Normal distribution?					
r-squared is: 0.93		r-squared is: 0.41					
Recommendations:							
Use lognormal distribution.							
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:				
L		90	36.01	0.0000			
L = lognormal		50th	16.80	0.0000			
N = normal		4 X 50th	67.19	0.0000			
X = neither (so use nonparametric method)		Coefficient of Variation = 0.65					

4
4.045
4.125
4.33
4.4
5.04
5.18
5.2
5.415
6.23
7.2
7.415
7.59
8.05
8.846667
8.973333
9
9.1
9.71
10
10.695
10.8
10.8
10.84933
10.96
11.1
11.235
11.46667
11.6
11.66667
11.75
11.85
11.85
11.9
11.95
12
12.4
12.5
12.7
12.795
12.9
12.95
13
13
13.05
13.2
13.2
13.3
13.30714
13.35
13.4
13.5
13.75
13.86667
13.95
14
14
14.075
14.14333
14.23333
14.3
14.4
14.45

MTCATStat Background Calculations
COPPER DATA

14.45

14.6

14.6825

14.7

14.8

14.93333

15

15.23333

15.83538

15.8625

16

16

16.025

16.10714

16.2

16.3

16.35

16.4

17

17

17.13333

17.1625

17.3

17.3

17.56667

17.6

17.7

17.75

18

18.04286

18.1

18.15

18.25

18.55

18.55

18.61429

18.7

18.75

18.85

18.9

19.16667

19.5

19.6

19.63571

19.8

19.95

20.1

20.13333

20.2

20.3

20.5

20.65

20.7

21

21

21.03333

21.2

21.3

21.5

21.56667

21.9

22

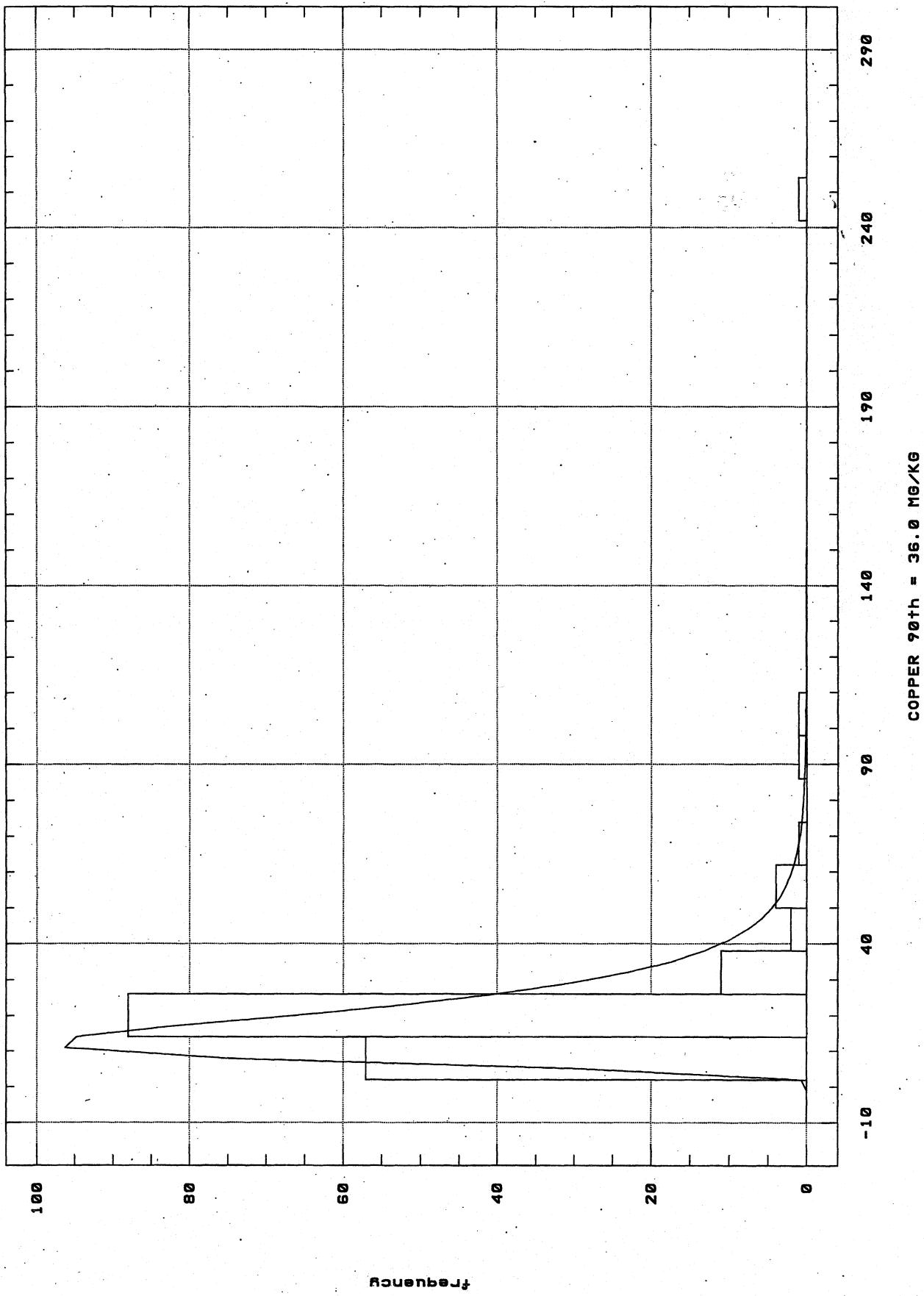
22.33333

22.5

MTCATStat Background Calculations
COPPER DATA

22.8
23.05
23.2
23.3
23.33846
23.5
23.825
24.4
24.6
24.9
24.9
25
25
25.15
25.3
25.4
25.65
25.725
27.03333
27.06667
27.3
28.7
29.03333
29.2
29.24
29.65
30.96667
32.03077
33.9
39.25
42.84286
50.15
50.9
51.71429

STATEWIDE COPPER DISTRIBUTION



MTCASStat Background Calculations

4.33
4.4
5.04
5.18
5.2
6.23
7.2
8.05
18.7
22.5
23.2
24.4
33.9
50.9
99.4

Cu - GROUP "W"
REGIONS A,C,D - WESTERN WASHINGTON

Number of samples		Uncensored values					
Uncensored	15	Mean	21.24				
Censored	0	Lognormal mean	21.14				
TOTAL	15	Std. devn.	25.52				
		Median	8.05				
		Min.	4.33				
		Max.	99.4				
Lognormal distribution?		Normal distribution?					
r-squared is: 0.90		r-squared is: 0.68					
Recommendations:							
Use lognormal distribution.							
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:				
L		90	52.85				
L = lognormal		50th	12.75				
N = normal		4 X 50th	50.99				
X = neither (so use nonparametric method)		Coefficient of Variation = 1.56					

MTCASat Background Calculations

Cu - CLARK COUNTY

9.71
10.695
11.95
12.795
13.95
14.23333
15.83538
17
17.56667
18.15
20.7
21.2
21.56667
22
23.05
23.3
23.33846
23.825
24.9
25
25.4
25.65
29.2
30.96667
39.25
51.71429

Number of samples	Uncensored values			
	Uncensored	26	Mean	22.04
	Censored	0	Lognormal mean	22.08
	TOTAL	26	Std. devn.	9.06
			Median	21.783333
			Min.	9.71
			Max.	51.7142857
	Lognormal distribution?		Normal distribution?	
		r-squared is: 0.97		r-squared is: 0.87
	Recommendations:			
			Use lognormal distribution.	
	Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
	L	90	34.43	
	L = lognormal	50th	20.49	
	N = normal	4 X 50th	81.94	
	X = neither (so use nonparametric method)		Coefficient of Variation = 0.42	

MTCASat Background Calculations

Cu - PUGET SOUND BASIN

4
 7.59
 8.846667
 8.973333
 9
 10
 10.8
 10.84933
 11.235
 11.66667
 11.75
 11.85
 12
 12.5
 13
 13.75
 13.86667
 14
 14
 14.075
 14.3
 14.6825
 15
 16.10714
 17
 17.6
 18
 18.04286
 19.16667
 19.5
 19.8
 20.3
 20.65
 21
 21
 24.9
 25
 25.3
 29.24
 29.65
 32.03077
 42.84286
 64.55
 86.65
 243.5

Number of samples		<u>Uncensored values</u>					
Uncensored	45	Mean	24.43				
Censored	0	Lognormal mean	21.90				
TOTAL	45	Std. devn.	36.38				
		Median	15				
		Min.	4				
		Max.	243.5				
Lognormal distribution?		Normal distribution?					
r-squared is: 0.86		r-squared is: 0.36					
Recommendations:							
Use nonparametric method.							
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:				
X		90	36.36				
L = lognormal		50th	15.00				
N = normal		4 X 50th	60.00				
X = neither (so use nonparametric method)							
Coefficient of Variation = N/A							

MTCASat Background Calculations

4.125
 12.4
 13.3
15.23333
 16.2
 16.4
17.13333
17.1625
 17.7
 17.75
 18.1
 18.55
 18.55
18.61429
 18.75
 18.85
 19.6
19.63571
 20.1
20.13333
 20.5
21.03333
 21.3
 21.5
22.33333
 22.8
 23.5
 24.6
 25.15
27.03333
27.06667
 50.15

Cu - YAKIMA BASIN

Number of samples		Uncensored values
Uncensored	32	Mean 20.16
Censored	0	Lognormal mean 20.38
TOTAL	32	Std. devn. 7.03
		Median 19.225
		Min. 4.125
		Max. 50.15
Lognormal distribution?		Normal distribution?
r-squared is: 0.74		r-squared is: 0.73
Recommendations:		
Use nonparametric method.		
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:
X	90	26.47
L = lognormal	50th	19.23
N = normal	4 X 50th	76.90
X = neither (so use nonparametric method)	Coefficient of Variation = N/A	

MTCASStat Background Calculations

Cu - SPOKANE BASIN

4.045
5.415
7.415
10.8
10.96
11.46667
11.85
12.95
13
13.05
13.30714
13.35
13.5
14.14333
14.4
14.45
14.45
14.93333
15.8625
16.025
16.3
17.3
17.3
18.25
19.95
25.725
29.03333

Number of samples	Uncensored values				
Uncensored	27	Mean	14.42		
Censored	0	Lognormal mean	14.59		
TOTAL	27	Std. devn.	5.19		
		Median	14.1433333		
		Min.	4.045		
		Max.	29.0333333		
Lognormal distribution?		Normal distribution?			
r-squared is: 0.87		r-squared is: 0.91			
Recommendations:					
Use normal distribution.					
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:			
N	90	21.61			
L = lognormal	50th	14.42			
N = normal	4 X 50th	57.66			
X = neither (so use nonparametric method)	Coefficient of Variation = 0.39				

MTCASat Background Calculations

Cu - GROUP "E"

REGIONS J,L,P,R - EASTERN WASHINGTON

9.1
11.1
11.6
11.9
12.7
12.9
13.2
13.2
13.4
14.6
14.7
14.8
16
16
16.35
18.9
20.2
21.9
27.3
28.7
53

Number of samples	Uncensored values						
Uncensored	21	Mean	17.69				
Censored	0	Lognormal mean	17.49				
TOTAL	21	Std. devn.	9.53				
		Median	14.7				
		Min.	9.1				
		Max.	53				
Lognormal distribution?		Normal distribution?					
r-squared is: 0.87		r-squared is: 0.65					
Recommendations:							
Use nonparametric method.							
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:				
<input checked="" type="radio"/> X		90	28.42				
L = lognormal		50th	14.70				
N = normal		4 X 50th	58.80				
Coefficient of Variation = N/A							

MTCASat Background Calculations
IRON DATA

IRON

STATEWIDE

5025

5920

9160

9670

10400

11100

11200

11300

11500

11700

12320

12517.5

12950

13000

13050

13200

13200

13353.85

13450

13533.33

13700

13900

13966.67

14100

14300

14300

14333.33

L

14662.5

14800

14900

15150

15300

15500

15550

15660

16100

16133.33

16200

16350

16350

16368.67

16550

16600

16700

16735.71

16800

17000

17000

17050

17100

17100

17100

17200

17300

17550

17650

17792.86

17900

18078.57

18150

18150

18200

18200

Number of samples		<u>Uncensored values</u>					
Uncensored	165	Mean	25,903.72				
Censored	0	Lognormal mean	25,835.70				
TOTAL	165	Std. devn.	13,978.67				
		Median	22,033.33				
		Min.	5,025.00				
		Max.	112,500.00				
Lognormal distribution?		Normal distribution?					
r-squared is: 0.98		r-squared is: 0.83					
Recommendations:							
Use lognormal distribution.							
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:				
L		90	43,106.14	0.0000			
L = lognormal		50th	22,987.15	0.0000			
N = normal		4 X 50th	91,948.59	0.0000			
Coefficient of Variation = 0.52							

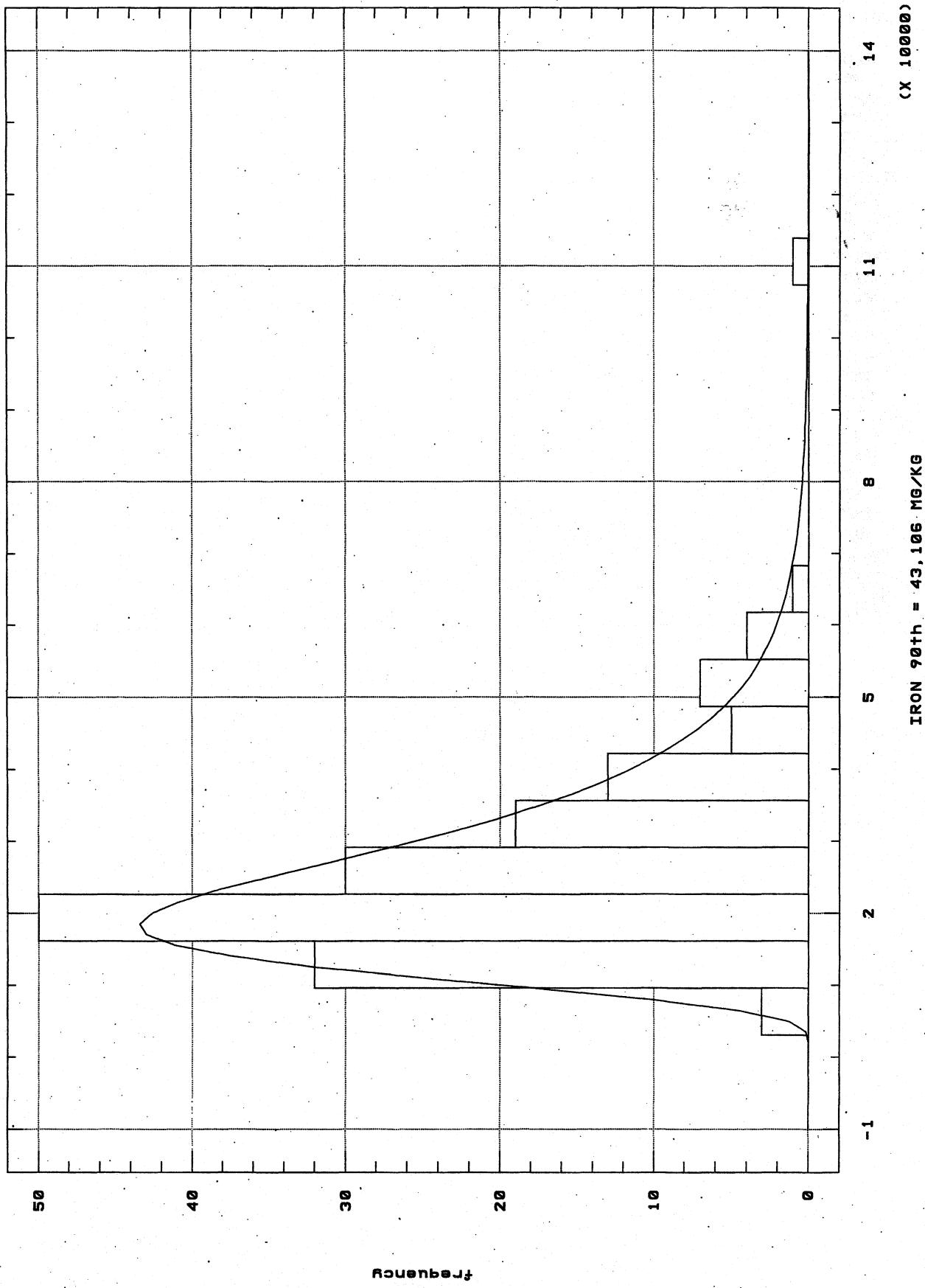
MTCASat Background Calculations
IRON DATA

18400
18400
19100
19450
19500
20000
20100
20200
20500
20525
20733.33
20800
21100
21225
21300
21350
21433.33
21633.33
21650
22033.33
22200
22300
22750
22900
23150
23300
23500
23900
24100
24550
24650
24700
24750
25000
25300
25850
26100
26100
26123.08
26200
26675
26900
27000
27071.43
27500
27700
27750
27800
28300
28642.86
29000
29040
29300
29300
30000
30050
30350
30600
30935.71
31400
31650
32600
32733.33
33000

MTCASat Background Calculations
IRON DATA

33100
33250
33350
33566.67
34500
35050
35450
35700
35933.33
37253.85
37450
37757.14
38400
39566.67
39600
39662.5
40400
41650
41700
41800
42200
42825
44700
45633.33
48625
49900
50200
52550
52850
53800
53933.33
54950
55571.43
58050

STATEWIDE IRON DISTRIBUTION



MTCAS Stat Background Calculations

9160
11100
11300
13200
13900
14100
17100
18200
23300
26100
33000
38400
41800
49900
62800

Fe - GROUP "W"

REGIONS J,L,P,R - WESTERN WASHINGTON

Number of samples	<u>Uncensored values</u>						
	Uncensored	15	Mean	25557.33			
	Censored	0	Lognormal mean	25757.52			
	TOTAL	15	Std. devn.	16247.65			
			Median	18200			
			Min.	9160			
			Max.	62800			
Lognormal distribution?		Normal distribution?					
r-squared is: 0.96		r-squared is: 0.88					
Recommendations:							
Use lognormal distribution.							
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:					
L	90	49170.89					
L = lognormal	50th	21446.18					
N = normal	4 X 50th	85784.73					
X = neither (so use nonparametric method)	Coefficient of Variation = 0.72						

MTCASat Background Calculations

16350
26123.08
29300
29300
31400
32733.33
33250
33350
35050
35700
35933.33
37253.85
37450
39566.67
41650
42200
42825
45633.33
48625
50200
52850
53933.33
54950
55571.43
58050
59850

Fe - CLARK COUNTY

Number of samples	Uncensored values								
	Uncensored	Censored	TOTAL	Mean	Lognormal mean				
			26	40734.55	40923.09				
			0						
			26	11005.31					
				Median 38508.3333					
				Min. 16350					
				Max. 59850					
Lognormal distribution?		Normal distribution?							
r-squared is: 0.93		r-squared is: 0.97							
Recommendations:									
Use lognormal distribution.									
Enter distribution (L, N or X)	L	Enter percentile	Value corresponding to that percentile is:						
L = lognormal		90	58665.27						
N = normal		50th	39180.95						
X = neither (so use nonparametric method)		4 X 50th	156723.80						
Coefficient of Variation = 0.32									

MTCASStat Background Calculations

5920
 11700
 12320
 12950
 13050
 13353.85
 13450
 13533.33
 13700
 14300
 14333.33
 14800
 14900
 15150
 15300
 15550
 15660
 16350
 16550
 16700
 16800
 17000
 17100
 17300
 17650
 17792.86
 17900
 18078.57
 18200
 19450
 20100
 20500
 20525
 21433.33
 25850
 26675
 27500
 27750
 29040
 34500
 37757.14
 40400
 52550
 112500

Fe - PUGET SOUND BASIN

Number of samples	Uncensored values								
	Uncensored	44	Mean	21680.05					
	Censored	0	Lognormal mean	21082.33					
	TOTAL	44	Std. devn.	16424.87					
			Median	17050					
			Min.	5920					
			Max.	112500					
Lognormal distribution?		Normal distribution?							
		r-squared is: 0.85							
		r-squared is: 0.52							
Recommendations:									
Use nonparametric method.									
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:						
X		90	36128.57						
L = lognormal		50th	17050.00						
N = normal		4 X 50th	68200.00						
X = neither (so use nonparametric method)									
Coefficient of Variation = N/A									

MTCASat Background Calculations

5025
 16368.67
 17200
 20733.33
 21350
 21633.33
 22033.33
 22750
 23150
 23900
 24550
 26900
 27071.43
 27800
 28300
 28642.86
 29000
 30050
 30350
 30600
 30935.71
 31650
 32600
 33100
 33566.67
 35450
 39600
 39662.5
 41700
 44700
 53800
 58800

Fe - YAKIMA BASIN

Number of samples		Uncensored values
Uncensored	32	Mean 29780.40
Censored	0	Lognormal mean 30339.72
TOTAL	32	Std. devn. 10562.32
		Median 28821.4286
		Min. 5025
		Max. 58800
Lognormal distribution?		Normal distribution?
r-squared is: 0.82		r-squared is: 0.94
Recommendations:		
Use normal distribution.		
Enter distribution (L, N or X)		Value corresponding to that percentile is:
L		90 51451.49
L = lognormal		50th 27689.82
N = normal		4 X 50th 110759.30
X = neither (so use nonparametric method)		Coefficient of Variation = 0.51

MTCASStat Background Calculations

9670
12517.5
13966.67
14300
14662.5
16100
16133.33
16600
16735.71
17000
17050
17550
18150
18150
18400
18400
19500
20000
20800
21100
21225
22300
24100
24650
24750
25300
27000

Fe - SPOKANE BASIN

Number of samples		Uncensored values					
Uncensored	27	Mean	18744.84				
Censored	0	Lognormal mean	18783.35				
TOTAL	27	Std. devn.	4172.08				
		Median	18150				
		Min.	9670				
		Max.	27000				
Lognormal distribution?		Normal distribution?					
r-squared is: 0.96		r-squared is: 0.98					
Recommendations:							
Use lognormal distribution.							
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:				
L		90	25026.20				
L = lognormal			50th 18278.16				
N = normal			4 X 50th 73112.65				
Coefficient of Variation = 0.25							

MTCASat Background Calculations

10400
11200
11500
13000
13200
15500
16200
17100
19100
20200
21300
21650
22200
22900
23500
24700
25000
26100
26200
27700
30000

Fe - GROUP "E"

REGIONS J,L,P,R - EASTERN WASHINGTON

Number of samples	<u>Uncensored values</u>				
Uncensored	21	Mean	19935.71		
Censored	0	Lognormal mean	20046.16		
TOTAL	21	Std. devn.	5885.98		
		Median	21300		
		Min.	10400		
		Max.	30000		
Lognormal distribution?		Normal distribution?			
r-squared is: 0.94		r-squared is: 0.97			
Recommendations:					
Use lognormal distribution.					
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:			
L	90	29631.58			
L = lognormal	50th	19027.40			
N = normal	4 X 50th	76109.59			
X = neither (so use nonparametric method)		Coefficient of Variation = 0.36			

MTCAS Stat Background Calculations
LEAD DATA

LEAD

STATEWIDE

Number of samples		<u>Uncensored values</u>					
Uncensored	151	Mean	10.05				
Censored	15	Lognormal mean	9.26				
TOTAL	166	Std. devn.	16.83				
		Median	7.90				
		Min.	2.10				
		Max.	207.50				
Lognormal distribution?		Normal distribution?					
r-squared is: 0.91		r-squared is: 0.23					
Recommendations:							
Use lognormal distribution.							
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:				
L		90	17.09	0.0000			
L = lognormal			50th	6.98			
N = normal			4 X 50th	27.92			
X = neither (so use nonparametric method)			Coefficient of Variation = 0.79				

MTCASat Background Calculations
LEAD DATA

6.1
6.1
6.2
6.35
6.4
6.433333
6.5
6.521429
6.55
6.6
6.65
6.7
6.7
6.728571
6.75
6.8
6.866667
7
7.05
7.166667
7.3
7.3
7.4
7.45
7.7
7.8
7.85
7.9
8
8
8.1
8.2
8.25
8.3
8.35
8.65
8.666667
8.733333
8.75
8.8
8.8
9.05
9.1
9.133333
9.185
9.5
9.5
9.657143
9.7
9.7
9.8
9.9
9.9
10
10
10.05
10.15
10.26
10.4
10.5
10.6
10.65
10.65
10.73333

MTCASat Background Calculations
LEAD DATA

10.77143

10.8

10.875

10.975

11

11.09

11.3

11.5

11.7

12

12

12

12.04385

12.23333

12.5

12.5

12.8

12.83333

12.9

13.5

13.5

13.5

13.7

13.72667

14.33333

14.925

15

15.2

15.66667

15.77857

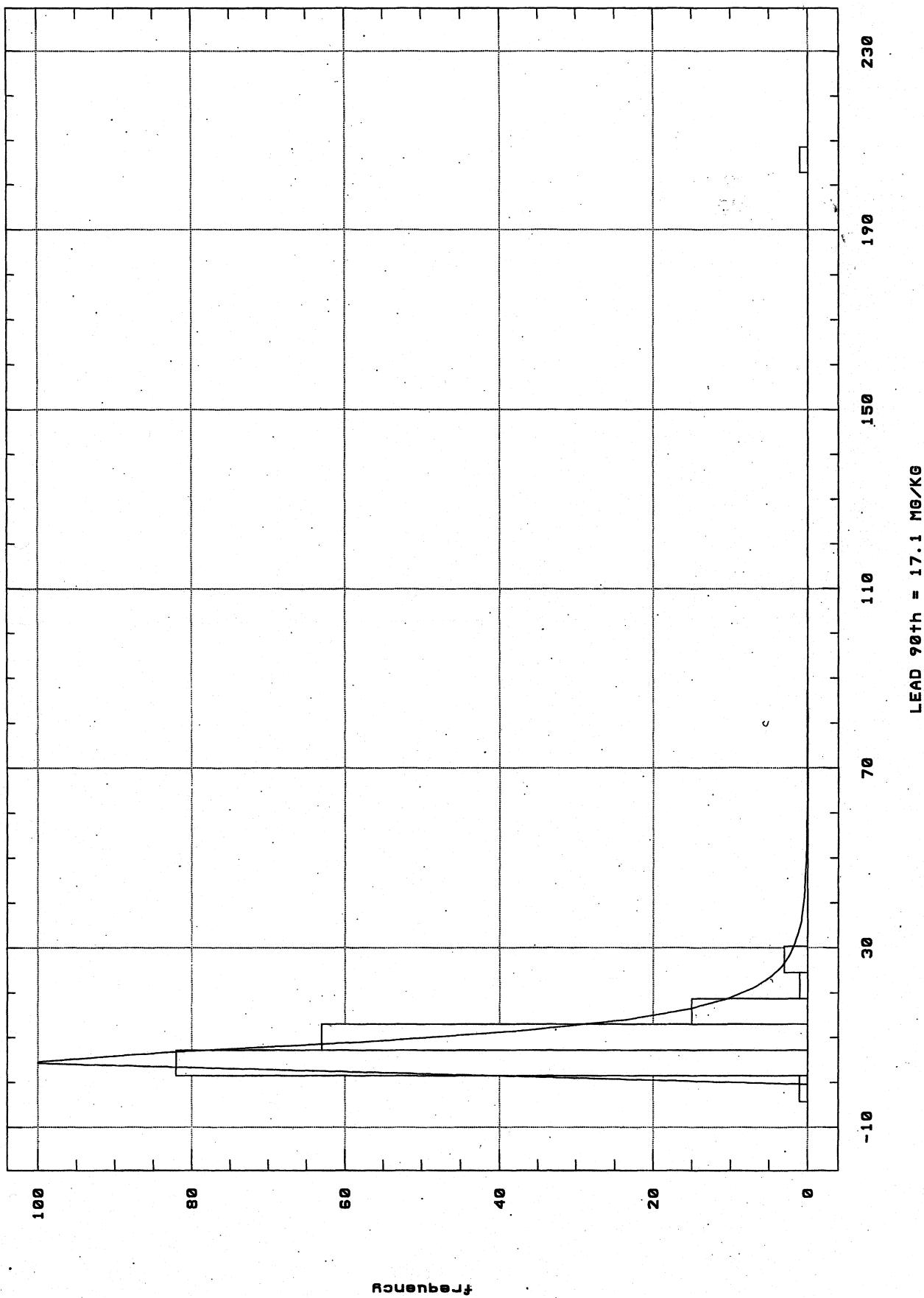
15.975

16

16.2

17.1

STATEWIDE LEAD DISTRIBUTION



MTCASStat Background Calculations

Pb - GROUP "W"

REGIONS A,C,D - WESTERN WASHINGTON

Number of samples		<u>Uncensored values</u>				
	Uncensored	15	Mean	5.63		
4	Censored	0	Lognormal mean	5.68		
4	TOTAL	15	Std. devn.	3.52		
4.7			Median	4		
5.2			Min.	2.1		
6.1			Max.	12		
9.7	Lognormal distribution?		Normal distribution?			
10	r-squared is: 0.94		r-squared is: 0.85			
12	Recommendations:					
12	Use lognormal distribution.					
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:			
L		90	10.87			
L = lognormal		50th	4.75			
N = normal		4 X 50th	18.98			
X = neither (so use nonparametric method)		Coefficient of Variation = 0.72				

MTCASat Background Calculations

Pb - CLARK COUNTY

<2
 4.65
 5.45
 5.5
 6.7
 7.3
 7.45
 7.7
 8.3
 8.65
8.733333
 9.1
 9.185
 9.8
10.73333
10.77143
 11.09
 11.3
12.04385
12.23333
 12.5
 12.9
 13.7
14.925
15.975
 29.6

Number of samples		Uncensored values
Uncensored	25	Mean 10.65
Censored	1	Lognormal mean 10.63
TOTAL	26	Std. devn. 4.93
		Median 9.8
		Min. 4.65
		Max. 29.6
Lognormal distribution?		Normal distribution?
r-squared is: 0.95		r-squared is: 0.79
Recommendations:		
Use lognormal distribution.		
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:
L	90	16.83
L = lognormal	50th	9.50
N = normal	4 X 50th	37.99
X = neither (so use nonparametric method)		Coefficient of Variation = 0.47

MTCASat Background Calculations

Pb - PUGET SOUND BASIN

Number of samples		<u>Uncensored values</u>					
Uncensored	31	Mean	15.88				
Censored	14	Lognormal mean	12.39				
TOTAL	45	Std. devn.	36.21				
		Median	6.86666667				
		Min.	2.125				
		Max.	207.5				
Lognormal distribution?		Normal distribution?					
r-squared is: 0.90		r-squared is: 0.37					
Recommendations:							
Use lognormal distribution.							
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:				
L		90	24.02				
L = lognormal		50th	4.47				
N = normal		4 X 50th	17.88				
X = neither (so use nonparametric method)		Coefficient of Variation = 2.14					

MTCASat Background Calculations

2.171429
3.875
4.066667
4.5
4.8625
5.133333
5.3
5.4
5.4
5.9
6.05
6.1
6.2
6.35
6.433333
6.5
6.55
6.65
6.728571
7
7.05
7.166667
7.3
7.4
7.85
8.1
8.25
9.133333
9.657143
9.7
15.2
17.1

Pb - YAKIMA BASIN

Number of samples		<u>Uncensored values</u>					
Uncensored	32	Mean	7.03				
Censored	0	Lognormal mean	7.04				
TOTAL	32	Std. devn.	2.90				
		Median	6.525				
		Min.	2.17142857				
		Max.	17.1				
Lognormal distribution?		Normal distribution?					
r-squared is: 0.92		r-squared is: 0.80					
Recommendations:							
Use lognormal distribution.							
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:				
L		90	11.00				
L = lognormal		50th		6.56			
N = normal		4 X 50th		26.24			
X = neither (so use nonparametric method)							
Coefficient of Variation = 0.42							

MTCASStat Background Calculations

Pb - SPOKANE BASIN

6.75
7.8
8.35
8.666667
8.75
8.8
9.05
9.5
10.05
10.5
10.6
10.65
10.65
10.8
10.875
11
11.5
12
12.5
12.8
12.83333
13.5
14.33333
15
15.66667
15.77857
16

Number of samples		<u>Uncensored values</u>					
Uncensored	27	Mean	11.29				
Censored	0	Lognormal mean	11.30				
TOTAL	27	Std. devn.	2.55				
		Median	10.8				
		Min.	6.75				
		Max.	16				
Lognormal distribution?		Normal distribution?					
r-squared is: 0.98		r-squared is: 0.97					
Recommendations:							
Use lognormal distribution.							
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:				
L		90	14.91				
N = lognormal		50th	11.01				
N = normal		4 X 50th	44.04				
Coefficient of Variation = 0.24							

MTCASat Background Calculations

4.2

4.2

4.8

5

5.3

5.4

5.8

5.9

5.95

6

6.4

6.6

6.7

6.8

8

8

8.8

9.5

9.9

10.4

11.7

Pb - GROUP "E"

REGIONS J.L.P,R - EASTERN WASHINGTON

Number of samples		Uncensored values			
Uncensored	21	Mean	6.92		
Censored	0	Lognormal mean	6.93		
TOTAL	21	Std. devn.	2.11		
		Median	6.4		
		Min.	4.2		
		Max.	11.7		
Lognormal distribution?		Normal distribution?			
r-squared is: 0.97		r-squared is: 0.93			
Recommendations:					
Use lognormal distribution.					
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:			
L	90	9.85			
L = lognormal	50th	6.64			
N = normal	4 X 50th	26.56			
X = neither (so use nonparametric method)	Coefficient of Variation = 0.32				

MTCASStat Background Calculations
MANGANESE DATA

MANGANESE

STATEWIDE DATA

		Number of samples		Uncensored values		
141.4		Uncensored	166	Mean	592.56	
149		Censored	0	Lognormal mean	595.61	
150		TOTAL	166	Std. devn.	395.53	
159				Median	509.58	
163				Min.	78.00	
164.45				Max.	2,750.00	
183.6667		Lognormal distribution?		Normal distribution?		
197		r-squared is: 0.99		r-squared is: 0.82		
216						
228.3333		Recommendations:				
229						
231						
231.5						
233						
234						
234.5						
245						
252						
252.75						
256						
268						
276.5		Enter distribution (L, N or X)		Enter percentile		Value corresponding to that percentile is:
277		L		90		1,094.85 1094.8454
279		L = lognormal		50th		492.82 1111.1408
284.3333		N = normal		4 X 50th		1,971.30 1078.5499
294		X = neither (so use nonparametric method)		Coefficient of Variation = 0.69		
299						
302.25						
303						
306.5						
310.4						
321						
325						
340						
345						
350.5714						
354.5						
361.5						
363						
365						
366						
366						
367.2143						
372						
374						
374.5						
376.5						
377						
378						
383.3077						
384.3333						
386						
387.5						
390.875						
392.5						
394.3333						
396.5						
411						
417.4286						

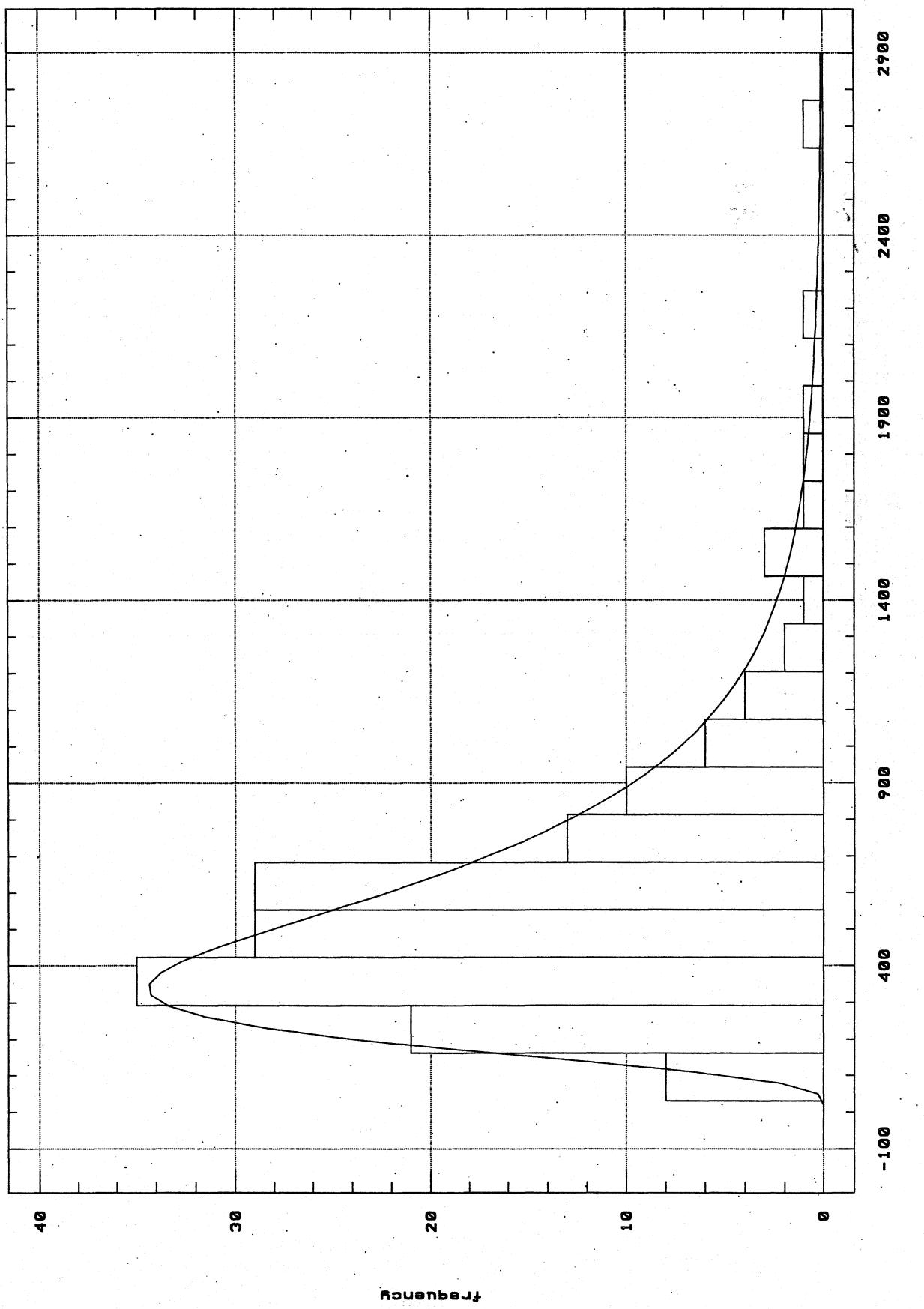
MTCASat Background Calculations
MANGANESE DATA

420.7692
427.6667
 430
 436
 445.5
 446
 454
 461
463.3333
464.6667
 470
 473.75
 475
 486
 488
493.5
494.5
 499
 505
 509.5
509.6667
 510
 516
 520.5
 523
 523
 525.5
 537
 540.5
547.3333
 555
557.3333
 557.5
 558
 561
 561.25
564.4286
565.6667
 571
 577.75
591.6667
 599
 607
 611
 613
 631
 631
 633
638.3571
 638.5
 652
 655
 659
659.9286
 665.5
 667.5
 671
 679.5
 680
 708.5
 716
 738
 740
 741.5

MTCASStat Background Calculations
MANGANESE DATA

753.5
761
763
764.75
769.5
770.5
786.5
807.5
818.5
829.6667
840
846
848
902.5
904.5
926.5
927
930
951
951.6
952.5
983.75
1008
1042
1077.25
1110
1119
1192.154
1210.857
1291.5
1375
1483.333
1525.5
1546.125

STATEWIDE MANGANESE DISTRIBUTION



MTCASat Background Calculations

78
107
112
149
159
197
229
231
277
303
366
537
631
633
930

Mn - GROUP "W"

REGIONS A,C,D - WESTERN WASHINGTON

Number of samples		<u>Uncensored values</u>			
	Uncensored	15	Mean 329.27		
	Censored	0	Lognormal mean 335.74		
	TOTAL	15	Std. devn. 246.48		
			Median 231		
			Min. 78		
			Max. 930		
Lognormal distribution?		Normal distribution?			
r-squared is: 0.98		r-squared is: 0.86			
Recommendations:					
Use lognormal distribution.					
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:		
L		90	691.75		
N = normal		50th	257.06		
X = neither (so use nonparametric method)		4 X 50th	1028.24		
Coefficient of Variation = 0.9					

MTCASat Background Calculations

150
231.5
420.7692
464.6667
509.5
659
665.5
667.5
807.5
829.6667
848
902.5
904.5
926.5
927
951
952.5
983.75
1042
1077.25
1110
1192.154
1483.333
1525.5
1836
1960.857

Mn - CLARK COUNTY

Number of samples		Uncensored values			
Uncensored	26	Mean	924.17		
Censored	0	Lognormal mean	956.78		
TOTAL	26	Std. devn.	432.53		
		Median	915.5		
		Min.	150		
		Max.	1960.85714		
Lognormal distribution?		Normal distribution?			
r-squared is: 0.89		r-squared is: 0.95			
Recommendations:					
Use normal distribution.					
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:			
N	90	1511.59			
L = lognormal	50th	924.17			
N = normal	4 X 50th	3696.68			
X = neither (so use nonparametric method)	Coefficient of Variation = 0.5				

MTCASat Background Calculations

Mn - PUGET SOUND BASIN

90
 141.4
 163
183.6667
 216
228.3333
 234.5
 252.75
 276.5
284.3333
 299
 302.25
 306.5
 310.4
 321
350.5714
 361.5
 365
367.2143
 374.5
383.3077
 387.5
 473.75
 499
509.6667
 523
 525.5
 557.5
 561
591.6667
 607
659.9286
 679.5
 738
 740
 753.5
 763
770.5
 818.5
 846
 951.6
1291.5
 1670
 2170
 2750

Number of samples		<u>Uncensored values</u>					
Uncensored	45	Mean	592.21				
Censored	0	Lognormal mean	584.83				
TOTAL	45	Std. devn.	511.10				
		Median	473.75				
		Min.	90				
		Max.	2750				
Lognormal distribution?		Normal distribution?					
r-squared is: 0.98		r-squared is: 0.70					
Recommendations:							
Use lognormal distribution.							
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:				
L		90	1146.25				
L = lognormal			50th 461.62				
N = normal			4 X 50th 1846.48				
X = neither (so use nonparametric method)							
Coefficient of Variation = 0.81							

MTCASat Background Calculations

164.45
 384.3333
 386
 392.5
 396.5
 427.6667
 486
 488
 493.5
 494.5
 510
 520.5
 540.5
 547.3333
 564.4286
 565.6667
 613
 631
 638.3571
 671
 680
 708.5
 716
 741.5
 761
 786.5
 840
 1008
 1119
 1210.857
 1375
 1546.125

Mn - YAKIMA BASIN

Number of samples		Uncensored values					
Uncensored	32	Mean	668.99				
Censored	0	Lognormal mean	672.23				
TOTAL	32	Std. devn.	300.40				
		Median	589.333333				
		Min.	164.45				
		Max.	1546.125				
Lognormal distribution?		Normal distribution?					
r-squared is: 0.94		r-squared is: 0.87					
Recommendations:							
Use lognormal distribution.							
Enter distribution (L, N or X)		Value corresponding to that percentile is:					
L		Enter percentile	1104.84				
L = lognormal		90	611.46				
N = normal		50th	2445.82				
X = neither (so use nonparametric method)		4 X 50th	Coefficient of Variation = 0.49				

MTCASat Background Calculations

Mn - SPOKANE BASIN

354.5
366
374
376.5
390.875
394.3333
417.4286
436
445.5
446
454
461
463.3333
470
475
505
555
557.3333
558
561.25
577.75
599
611
638.5
655
764.75
769.5

Number of samples		<u>Uncensored values</u>			
Uncensored	27	Mean	506.54		
Censored	0	Lognormal mean	506.73		
TOTAL	27	Std. devn.	114.86		
		Median	470		
		Min.	354.5		
		Max.	769.5		
Lognormal distribution?		Normal distribution?			
r-squared is: 0.97		r-squared is: 0.94			
Recommendations:					
Use lognormal distribution.					
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:		
L		90	663.48		
N = normal		50th	494.78		
X = neither (so use nonparametric method)		4 X 50th	1979.12		
Coefficient of Variation = 0.23					

MTCASat Background Calculations

Mn - GROUP "E"

REGIONS J,L,P,R - EASTERN WASHINGTON

233	Number of samples				Uncensored values			
234	Uncensored	21	Mean	364.95				
245	Censored	0	Lognormal mean	365.18				
252	TOTAL	21	Std. devn.	117.77				
256			Median	345				
268			Min.	233				
279			Max.	652				
294								
325								
340								
345								
363								
372	Lognormal distribution?				Normal distribution?			
377	r-squared is: 0.96				r-squared is: 0.91			
378								
411	Recommendations:							
430								
516								
523								
571								
652								
					Use lognormal distribution.			

MTCASStat Background Calculations
MERCURY DATA

MERCURY

STATEWIDE DATA

Number of samples		<u>Uncensored values</u>					
	Uncensored	166	Mean	0.03			
	Censored	0	Lognormal mean	0.03			
	TOTAL	166	Std. devn.	0.03			
			Median	0.02			
			Min.	0.00			
			Max.	0.19			
Lognormal distribution?		Normal distribution?					
r-squared is: 0.99		r-squared is: 0.80					
Recommendations:							
Use lognormal distribution.							
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:				
L		90	0.07	0.0656			
L = lognormal		50th					
N = normal		4 X 50th					
X = neither (so use nonparametric method)		0.02					
Coefficient of Variation = 1.02							

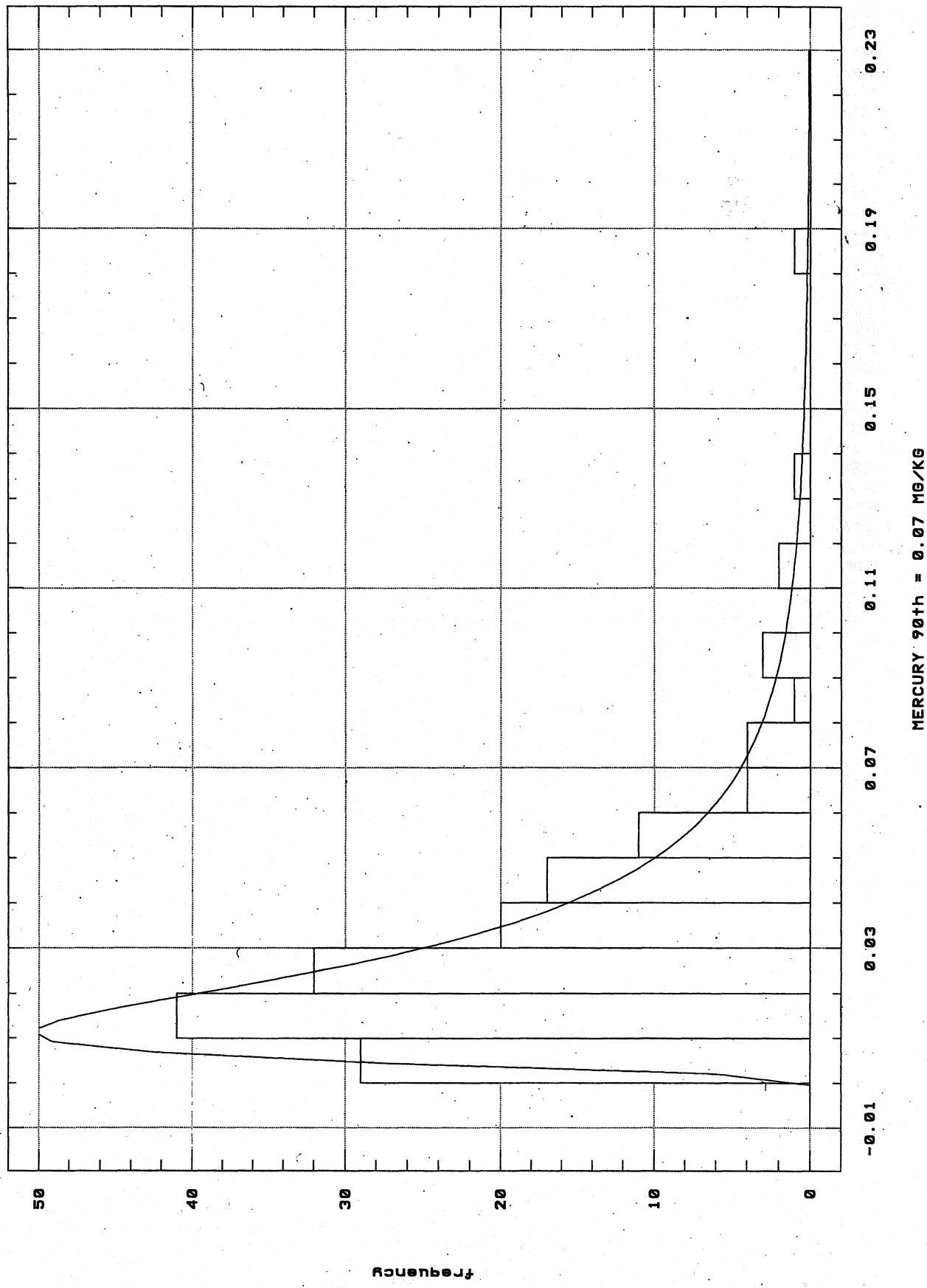
MTCASat Background Calculations
MERCURY DATA

0.0185
0.018914
0.019
0.0192
0.02
0.02
0.02
0.0205
0.0205
0.0205
0.021
0.021
0.021
0.021
0.0215
0.021667
0.021779
0.022
0.0225
0.023
0.024
0.025
0.0256
0.025846
0.0265
0.0265
0.026667
0.027
0.0275
0.02775
0.028
0.028333
0.0285
0.0285
0.0285
0.029
0.0292
0.03
0.03
0.0302
0.030333
0.030464
0.031
0.031
0.031
0.0315
0.032
0.033
0.03325
0.033333
0.0345
0.035
0.0356
0.035667
0.036
0.0365
0.037333
0.038
0.04
0.0406
0.042
0.042
0.0425
0.04265

MTCASat Background Calculations
MERCURY DATA

0.043
0.043457
0.0445
0.04475
0.045
0.045033
0.0455
0.046
0.047
0.0475
0.047931
0.04974
0.051
0.052
0.052
0.05325
0.053633
0.05485
0.055
0.05635
0.05675
0.058
0.06
0.061
0.0631
0.065725
0.066833
0.07435
0.07595
0.076
0.077308
0.082
0.093
0.09395

STATEWIDE MERCURY DISTRIBUTION



MTCASat Background Calculations

0.009
0.009
0.01
0.011
0.011
0.021
0.031
0.038
0.042
0.045
0.055
0.061
0.093
0.119
0.185

Hg - GROUP "W"

REGIONS A,C,D - WESTERN WASHINGTON

Number of samples	<u>Uncensored values</u>								
	Uncensored	15	Mean	0.05					
	Censored	0	Lognormal mean	0.05					
	TOTAL	15	Std. devn.	0.05					
			Median	0.038					
			Min.	0.009					
			Max.	0.185					
Lognormal distribution?		Normal distribution?							
r-squared is: 0.94		r-squared is: 0.79							
Recommendations:									
Use lognormal distribution.									
Enter distribution (L, N or X)		Enter percentile		Value corresponding to that percentile is:					
L		90		0.13					
L = lognormal		50th		0.03					
N = normal		4 X 50th		0.13					
Coefficient of Variation = 1.47									

MTCASat Background Calculations

0.0125
0.01375
0.0192
0.02
0.02
0.0205
0.0205
0.021
0.021667
0.022
0.0256
0.025846
0.026667
0.0285
0.0285
0.03
0.031
0.031
0.0315
0.033333
0.035
0.04
0.0425
0.0455
0.047931

Hg - CLARK COUNTY

Number of samples		Uncensored values
Uncensored	26	Mean 0.03
Censored	0	Lognormal mean 0.03
TOTAL	26	Std. devn. 0.01
		Median 0.02625641
		Min. 0.0125
		Max. 0.04793077
Lognormal distribution?		Normal distribution?
r-squared is: 0.97		r-squared is: 0.95
Recommendations:		
Use lognormal distribution.		
Enter distribution (L, N or X)		Value corresponding to that percentile is:
L		90 0.04
L = lognormal		50th 0.03
N = normal		4 X 50th 0.10
X = neither (so use nonparametric method)		Coefficient of Variation = 0.37

MTCASat Background Calculations

Hg - PUGET SOUND BASIN

0.012
 0.021779
 0.0265
 0.027
 0.02775
 0.028
 0.0285
 0.029
 0.0292
 0.03
 0.0302
 0.033
 0.03325
 0.0356
 0.036
 0.0365
 0.037333
 0.042
 0.04265
 0.043
 0.043457
 0.0445
 0.04475
 0.045033
 0.046
 0.047
 0.0475
 0.04974
 0.052
 0.052
 0.05325
 0.053633
 0.05485
 0.05635
 0.05675
 0.058
 0.06
 0.0631
 0.065725
 0.066833
 0.07595
 0.076
 0.077308
 0.09395
 0.094407

Number of samples	Uncensored values								
	Uncensored	45	Mean	0.05					
	Censored	0	Lognormal mean	0.05					
	TOTAL	45	Std. devn.	0.02					
			Median	0.04475					
			Min.	0.012					
			Max.	0.09440714					
Lognormal distribution?		Normal distribution?							
r-squared is: 0.97		r-squared is: 0.95							
Recommendations:									
Use lognormal distribution.									
Enter distribution (L, N or X)		Enter percentile		Value corresponding to that percentile is:					
L		90		0.07					
L = lognormal		50th		0.04					
N = normal		4 X 50th		0.17					
X = neither (so use nonparametric method)									
Coefficient of Variation = 0.44									

MTCASat Background Calculations

0.00725
 0.01
 0.0105
 0.011
 0.011
 0.0123
 0.014
 0.0155
 0.016
 0.016143
 0.0165
 0.017
 0.017333
 0.017714
 0.018914
 0.0205
 0.021
 0.023
 0.024
 0.0265
 0.0275
 0.028333
 0.030333
 0.030464
 0.032
 0.0345
 0.035667
 0.0406
 0.051
 0.07435
 0.082
 0.1165

Hg - YAKIMA BASIN

Number of samples		<u>Uncensored values</u>			
Uncensored	32	Mean	0.03		
Censored	0	Lognormal mean	0.03		
TOTAL	32	Std. devn.	0.02		
		Median	0.02075		
		Min.	0.00725		
		Max.	0.1165		
Lognormal distribution?		Normal distribution?			
r-squared is: 0.96		r-squared is: 0.71			
Recommendations:					
Use lognormal distribution.					
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:		
L		90	0.05		
L = lognormal		50th	0.02		
N = normal		4 X 50th	0.09		
X = neither (so use nonparametric method)		Coefficient of Variation = 0.75			

MTCASat Background Calculations

0.00425
0.00475
0.0054
0.00565
0.006164
0.00635
0.0065
0.008
0.009475
0.0105
0.01075
0.01195
0.012
0.01225
0.012667
0.014
0.014063
0.014333
0.014625
0.01625
0.0168
0.0172
0.0185
0.019
0.0215
0.0225
0.1312

Hg - SPOKANE BASIN

Number of samples	<u>Uncensored values</u>							
	Uncensored	27	Mean	0.02				
	Censored	0	Lognormal mean	0.02				
	TOTAL	27	Std. devn.	0.02				
			Median	0.01225				
			Min.	0.00425				
			Max.	0.1312				
Lognormal distribution?			Normal distribution?					
r-squared is: 0.85			r-squared is: 0.36					
Recommendations:								
Use nonparametric method.								
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:					
X		90	0.02					
L = lognormal		50th	0.01					
N = normal		4 X 50th	0.05					
Coefficient of Variation = N/A								

MTCASat Background Calculations

Hg - GROUP "E"

REGIONS J,L,P,R - EASTERN WASHINGTON

Number of samples		Uncensored values					
Uncensored	21	Mean	0.01				
Censored	0	Lognormal mean	0.01				
TOTAL	21	Std. devn.	0.01				
		Median	0.007				
		Min.	0.004				
		Max.	0.025				
Lognormal distribution?		Normal distribution?					
r-squared is: 0.89		r-squared is: 0.82					
Recommendations:							
Use nonparametric method.							
Enter distribution (L, N or X)	X	Enter percentile	90	Value corresponding to that percentile is: 0.02			
L = lognormal		50th		0.01			
N = normal		4 X 50th		0.03			
X = neither (so use nonparametric method)		Coefficient of Variation = N/A					

MTCAS Stat Background Calculations

NICKEL DATA

NICKEL

STATEWIDE DATA

Number of samples		<u>Uncensored values</u>					
Uncensored	166	Mean	21.49				
Censored	0	Lognormal mean	20.36				
TOTAL	166	Std. devn.	24.44				
		Median	16.43				
		Min.	2.15				
		Max.	244.50				
Lognormal distribution?		Normal distribution?					
r-squared is: 0.93		r-squared is: 0.44					
Recommendations:							
Use lognormal distribution.							
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:				
L		90	38.19	38.1907			
L = lognormal		50th	16.92	39.8195			
N = normal		4 X 50th	67.68	36.5618			
X = neither (so use nonparametric method)		Coefficient of Variation = 0.71					

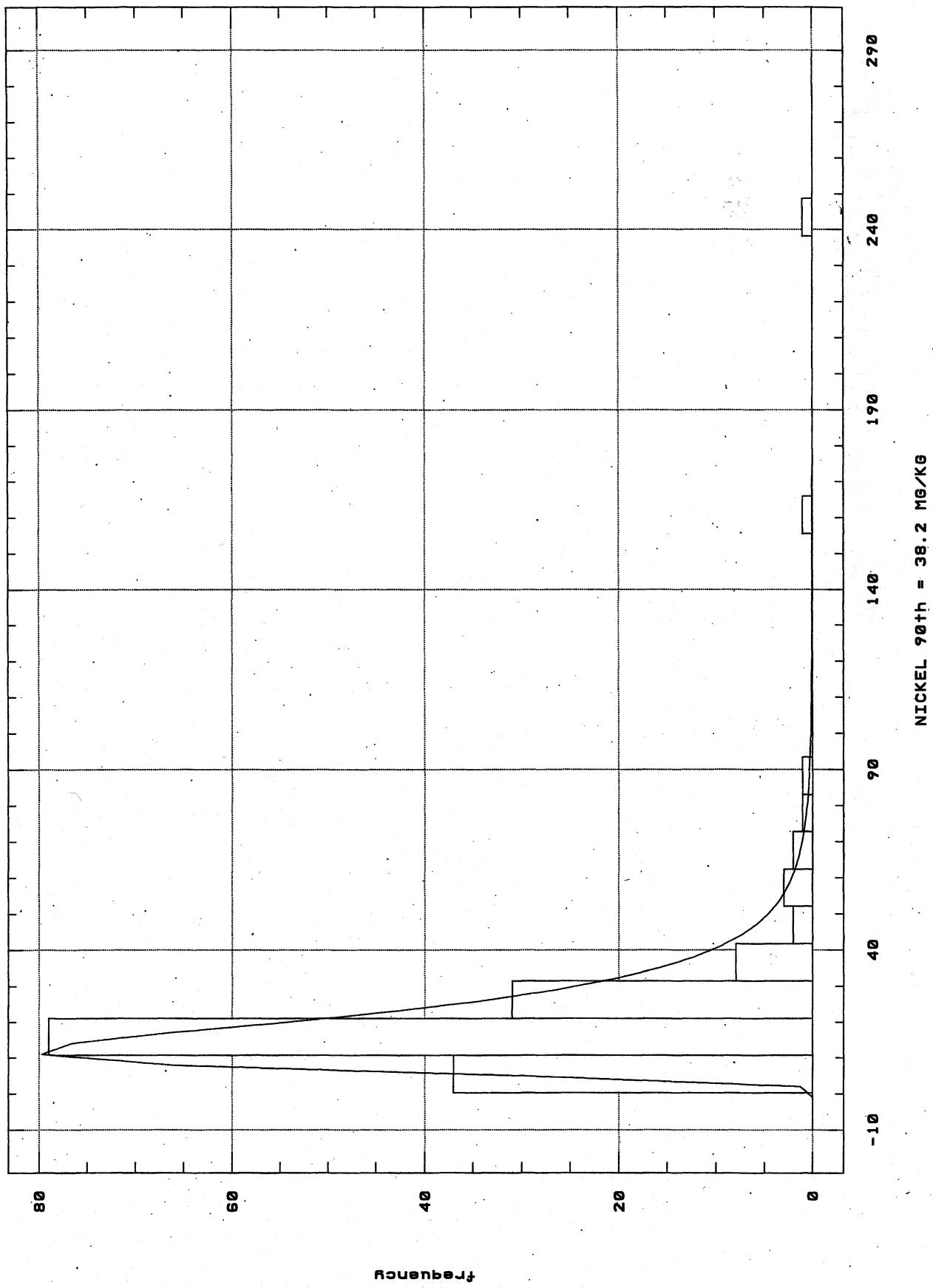
MTCASat Background Calculations
NICKEL DATA

13.76667	
	14
	14.2
	14.3
14.32857	
14.53333	
	14.75
	14.8
	14.95
	15.35
	15.5
	15.775
15.96667	
	16
16.06667	
	16.1
	16.2
16.26667	
	16.35
	16.4
16.46154	
	16.5
	16.7
	16.7
	17
	17
17.06667	
	17.3
	17.35
	17.4
	17.4
	17.975
	18
18.17143	
	18.3
	18.35
	18.5
	18.6
	18.7
18.83333	
	18.9
	19
	19.05
	19.1
	19.1
	19.1
	19.3
	19.3
	19.4
	19.6
20.26923	
	20.8
	20.95
	21.5
	21.5
21.62857	
	21.7
	22
	22
	22
22.13333	
	22.3
22.33333	
	22.75

MTCASat Background Calculations
NICKEL DATA

22.85
23
23
23.2
24
24
24.6
24.63333
24.66667
25
25
25.23333
25.24615
25.8
26.5
26.8
27.26667
28.95
29.9
31.3
34
34.1
34.95
36.3
36.86
38
39.8
40.36667
44.5
48.25
52.7
54.68571
57.45
63.2

STATEWIDE NICKEL DISTRIBUTION



MTCATStat Background Calculations

7.6
8.7
9
10
10.3
11.9
14.2
19.1
19.6
22.3
26.8
31.3
39.8
63.2
91.1

Ni - GROUP "W"

REGIONS "A", "C", "D"

Number of samples		Uncensored values					
	Uncensored	15	Mean	25.66			
	Censored	0	Lognormal mean	25.38			
	TOTAL	15	Std. devn.	23.47			
			Median	19.1			
			Min.	7.6			
			Max.	91.1			
Lognormal distribution?		Normal distribution?					
r-squared is: 0.94		r-squared is: 0.74					
Recommendations:							
Use lognormal distribution.							
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:				
L		90	54.19				
N = normal		50th	19.12				
X = neither (so use nonparametric method)		4 X 50th	76.46				
Coefficient of Variation = 0.97							

MTCASat Background Calculations

Ni - CLARK COUNTY

7
9.35
12
12.6
12.65
12.75
13.55
13.76667
14.3
14.32857
14.75
15.96667
16.2
16.26667
16.46154
17.4
17.975
18.5
18.83333
18.9
19
19.05
19.3
20.26923
22.85
66.75

Number of samples		Uncensored values
Uncensored	26	Mean 17.72
Censored	0	Lognormal mean 17.44
TOTAL	26	Std. devn. 10.61
		Median 16.2333333
		Min. 7
		Max. 66.75
Lognormal distribution?		Normal distribution?
r-squared is: 0.79		r-squared is: 0.48
Recommendations:		
Use nonparametric method.		
Enter distribution (L, N or X)		Value corresponding to that percentile is:
X		90 21.04
L = lognormal		50th 16.23
N = normal		4 X 50th 64.93
X = neither (so use nonparametric method)		Coefficient of Variation = N/A

MTCASat Background Calculations

Ni - PUGET SOUND BASIN

9							
10.05							
10.65							
12.05							
12.975							
16	Number of samples	Uncensored	45	Uncensored values			
17	Censored	0		Mean	29.82		
17.06667	TOTAL	45		Lognormal mean	27.94		
17.35				Std. devn.	34.45		
18				Median	23		
18.17143				Min.	9		
18.7				Max.	244.5		
19.1	Lognormal distribution?			Normal distribution?			
21.5							
21.5				r-squared is: 0.35			
21.62857	Recommendations:						
21.7							
22							
22							
22							
22.33333	Use nonparametric method.						
22.75							
23							
23							
23.2							
24							
24.63333	X	Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:			
24.66667	L = lognormal		90	47.78			
25	N = normal		50th	23.00			
25	X = neither (so use nonparametric method)		4 X 50th	92.00			
25.23333	Coefficient of Variation = N/A						
25.24615							
25.8							
26.5							
27.26667							
29.9							
34							
34.95							
36.3							
36.86							
44.5							
52.7							
54.68571							
57.45							
244.5							

MTCASat Background Calculations

2.15
8.55
9.8
10.3
10.7
12.68571
12.9
13.25357
13.55
14.53333
14.8
14.95
15.35
15.5
16.06667
16.1
16.35
17.3
17.4
18.3
18.35
19.1
19.3
20.95
22.13333
24
28.95
38
40.36667
48.25
81.75714
163

Ni - YAKIMA BASIN

Number of samples		Uncensored values					
Uncensored	32	Mean	24.83				
Censored	0	Lognormal mean	23.73				
TOTAL	32	Std. devn.	29.11				
		Median	16.225				
		Min.	2.15				
		Max.	163				
Lognormal distribution?		Normal distribution?					
r-squared is: 0.85		r-squared is: 0.49					
Recommendations:							
Use nonparametric method.							
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:				
X		90	45.89				
L = lognormal		50th	16.23				
N = normal		4 X 50th	64.90				
Coefficient of Variation = N/A							

MTCASat Background Calculations

Ni - SPOKANE BASIN

4.6
4.9
8.1
8.325
8.7
9.2
9.466667
9.65
9.75
9.8
9.85
9.875
10.03333
10.15
10.36643
10.85125
11.4
11.8
12.05
12.2
12.35
12.45
12.55
15.775
16.4
16.7
18.6

Number of samples		Uncensored values					
Uncensored	27	Mean	10.96				
Censored	0	Lognormal mean	11.01				
TOTAL	27	Std. devn.	3.20				
		Median	10.15				
		Min.	4.6				
		Max.	18.6				
Lognormal distribution?		Normal distribution?					
r-squared is: 0.90		r-squared is: 0.93					
Recommendations:							
Use lognormal distribution.							
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:				
L		90	16.19				
L = lognormal			50th 10.49				
N = normal			4 X 50th 41.96				
X = neither (so use nonparametric method)							
Coefficient of Variation = 0.35							

MTCASat Background Calculations

6.4

7.1

7.7

7.8

9.2

9.5

9.7

10.65

10.7

11.2

11.7

12.2

12.3

14

16.5

16.7

17

19.4

20.8

24.6

34.1

Ni - GROUP "E"

REGIONS J,L,P,R - EASTERN WASHINGTON

Number of samples	<u>Uncensored values</u>				
Uncensored	21	Mean	13.77		
Censored	0	Lognormal mean	13.75		
TOTAL	21	Std. devn.	6.71		
		Median	11.7		
		Min.	6.4		
		Max.	34.1		
Lognormal distribution?		Normal distribution?			
r-squared is: 0.97		r-squared is: 0.85			
Recommendations:					
Use lognormal distribution.					
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:			
L	90	22.41			
L = lognormal	50th	12.54			
N = normal	4 X 50th	50.14			
X = neither (so use nonparametric method)	Coefficient of Variation = 0.48				

MTCASat Background Calculations
ZINC DATA

ZINC
STATEWIDE DATA

		Number of samples		Uncensored values		
24.43333		Uncensored	166	Mean	55.53	
24.6		Censored	0	Lognormal mean	55.68	
26.3		TOTAL	166	Std. devn.	21.55	
27.5				Median	51.12	
28.6				Min.	12.00	
28.66667				Max.	132.50	
29		Lognormal distribution?		Normal distribution?		
29.7		r-squared is: 0.99		r-squared is: 0.95		
30.3						
30.7						
31						
31.4						
31.5						
32.3						
32.3						
32.4						
32.7						
33						
33.25						
33.95						
34		Enter distribution (L, N or X)		Enter percentile		Value corresponding to that percentile is:
35.8		L		90		85.82 85.8205
36.3		L = lognormal		50th		51.56 87.3942
36.7		N = normal		4 X 50th		206.23 84.2468
37.4		X = neither (so use nonparametric method)		Coefficient of Variation = 0.41		
38						
38						
39						
39.26667						
39.4						
39.6						
39.7						
40.61429						
40.85						
41						
41.03333						
41.05						
41.7						
42						
42.2						
42.4						
42.4875						
42.5						
43						
43.2						
43.35						
43.6						
43.65						
43.75						
43.8						
43.95385						
44.05						
44.25						
44.3						
44.3						
44.5						
44.5						
44.7						

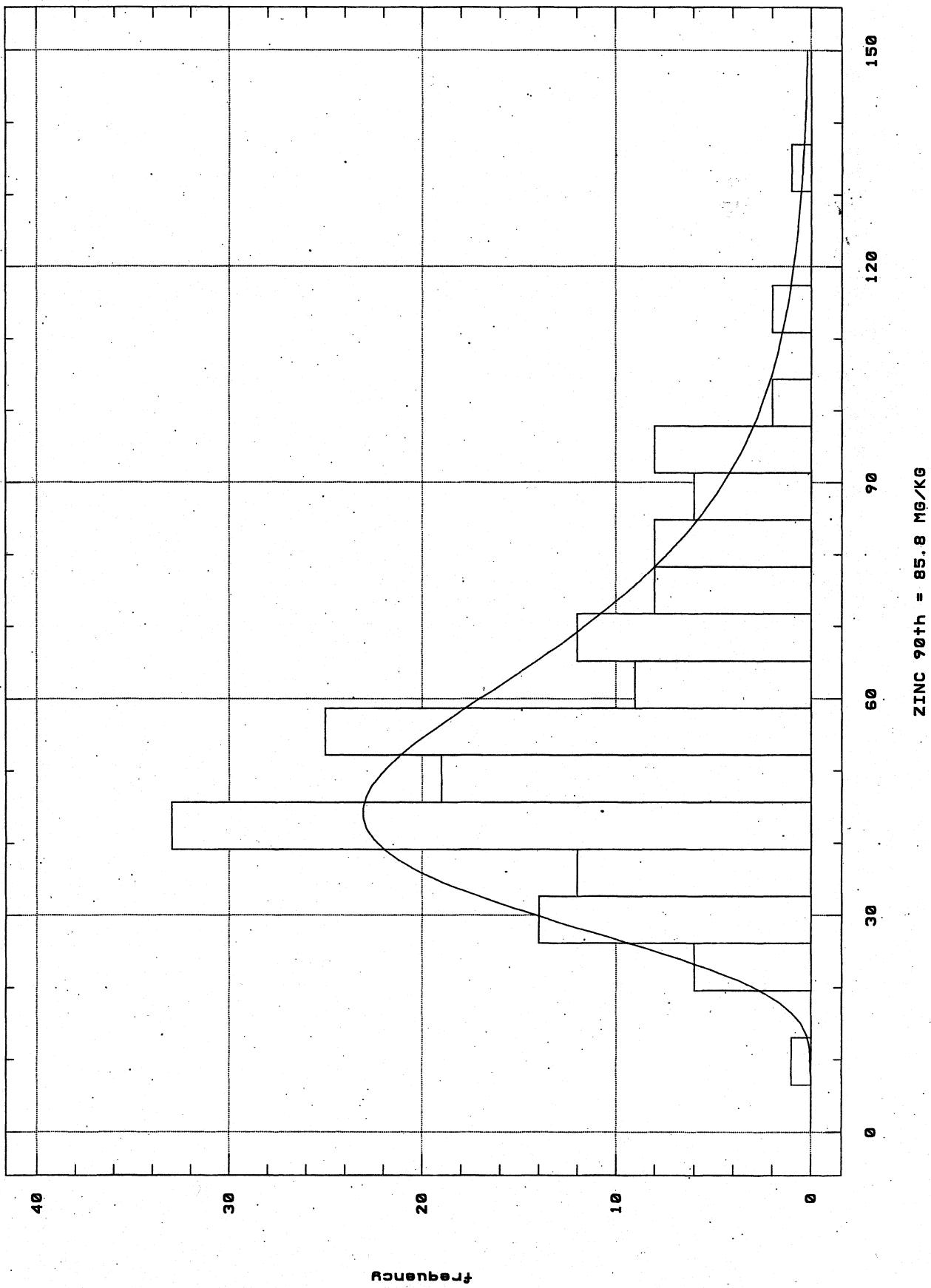
MTCASat Background Calculations
ZINC DATA

45
45.15
45.55
45.7
46.15
46.3
46.6
46.8
47.1
47.23333
47.575
47.65
47.95
48.15
48.50714
49.4
49.72143
50.35
50.4
50.89286
51.35
51.8
52.35
52.56667
52.575
52.7
53.05
53.3
53.35
53.6
53.8
53.9
54
54.15
54.6
54.75
55.65
55.9
56
56
56.4
56.85
58
58
58.3
58.45
58.46429
60.3
60.6
60.7
61.325
61.8
62.9125
63
63.1
64.3
66.15
67.1
67.16667
67.45
67.86667
68.1
68.4
69.45

MTCASat Background Calculations
ZINC DATA

70.8
71
71
71.38571
74.9
75.2
75.4
76.4
77.1
77.43333
77.9
78.1
78.85
79.9
81.45
82
82.3
83.8
84.5
84.68462
86
89.33333
89.4
89.51538
90.5
90.7
92.1
92.2
92.5
93
94.17143
94.75
97.3
97.7

STATEWIDE ZINC DISTRIBUTION



MTCASat Background Calculations

Zn - GROUP "W"

REGIONS A,C,D - WESTERN WASHINGTON

21.1
24.1
24.4
24.6
27.5
36.7
42.4
44.5
45
53.8
54
63
63.1
86
116

Number of samples		Uncensored values					
Uncensored	15	Mean	48.41				
Censored	0	Lognormal mean	48.66				
TOTAL	15	Std. devn.	26.17				
		Median	44.5				
		Min.	21.1				
		Max.	116				
Lognormal distribution?		Normal distribution?					
r-squared is: 0.96		r-squared is: 0.87					
Recommendations:							
Use lognormal distribution.							
Enter distribution (L, N or X)	L	Enter percentile	90	Value corresponding to that percentile is: 85.56			
L = lognormal		50th		42.85			
N = normal		4 X 50th		171.39			
X = neither (so use nonparametric method)				Coefficient of Variation = 0.58			

MTCASat Background Calculations

21.4
33.95
56.85
58
64.3
66.15
67.1
67.86667
69.45
71.38571
74.9
76.4
77.1
79.9
83.8
84.5
84.68462
89.33333
89.51538
92.1
92.2
92.5
93
94.75
97.3
97.7

Zn - CLARK COUNTY

Number of samples	Uncensored values				
Uncensored	26	Mean	76.01		
Censored	0	Lognormal mean	77.04		
TOTAL	26	Std. devn.	18.79		
		Median	78.5		
		Min.	21.4		
		Max.	97.7		
Lognormal distribution?		Normal distribution?			
r-squared is: 0.72		r-squared is: 0.88			
Recommendations:					
Use nonparametric method.					
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:			
X	90	95.52			
L = lognormal	50th	78.50			
N = normal	4 X 50th	314.00			
X = neither (so use nonparametric method)	Coefficient of Variation = N/A				

MTCASat Background Calculations

Zn - PUGET SOUND BASIN

12
24.43333
28.6

28.66667

29

31

32.3

32.3

32.7

33

33.25

34

35.8

36.3

38

38

39

40.61429

41.7

42.5

43

43.35

43.65

43.95385

44.5

45.15

46.8

47.65

52.35

52.575

54.15

54.6

56

58

58.45

67.16667

71

78.1

81.45

82

89.4

90.5

99

116.75

132.5

Number of samples	Uncensored values			
Uncensored	45	Mean	51.45	
Censored	0	Lognormal mean	51.50	
TOTAL	45	Std. devn.	24.93	
		Median	43.65	
		Min.	12	
		Max.	132.5	
Lognormal distribution?	Normal distribution?			
	r-squared is: 0.95			
	r-squared is: 0.86			
Recommendations:	Use lognormal distribution.			
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:		
L	90	85.06		
L = lognormal	50th	46.52		
N = normal	4 X 50th	186.08		
X = neither (so use nonparametric method)	Coefficient of Variation = 0.5			

MTCASat Background Calculations

39.26667
 40.85
 41.03333
 43.6
 43.75
 44.3
 44.7
 45.55
 45.7
 46.6
 47.23333
 48.50714
 49.72143
 50.4
 51.35
 52.7
 53.05
 53.6
 54.75
 55.9
 58.46429
 60.3
 60.6
 60.7
 62.9125
 68.1
 75.2
 77.43333
 78.85
 90.7
 94.17143
 101.4333

Zn - YAKIMA BASIN

Number of samples		Uncensored values					
Uncensored	32	Mean	57.54				
Censored	0	Lognormal mean	57.48				
TOTAL	32	Std. devn.	16.18				
		Median	52.875				
		Min.	39.266667				
		Max.	101.43333				
Lognormal distribution?		Normal distribution?					
r-squared is: 0.93		r-squared is: 0.86					
Recommendations:							
Use lognormal distribution.							
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:				
L		90	78.71				
L = lognormal		50th	55.66				
N = normal		4 X 50th	222.65				
X = neither (so use nonparametric method)							
Coefficient of Variation = 0.28							

MTCAS Stat Background Calculations

Zn - SPOKANE BASIN

Zn - SPOKANE BASIN					
41.05					
42					
42.4875					
43.2	Number of samples		<u>Uncensored values</u>		
44.05	Uncensored	27	Mean	51.77	
44.25	Censored	0	Lognormal mean	51.82	
44.3	TOTAL	27	Std. devn.	10.03	
46.15			Median	50.8928571	
46.3			Min.	29.7	
47.575			Max.	71	
48.15					
50.35	Lognormal distribution?		Normal distribution?		
50.89286					
51.8	r-squared is: 0.95		r-squared is: 0.95		
52.56667	Recommendations:				
53.3					
53.35					
53.9					
55.65					
56					
61.325			Use lognormal distribution.		
61.8					
67.45					
68.4					
70.8	Enter distribution (L, N or X)		Enter percentile	Value corresponding	
71	L		90	to that percentile is:	
	L = lognormal			66.35	
	N = normal		50th	50.83	
	X = neither (so use nonparametric method)		4 X 50th	203.33	
			Coefficient of Variation = 0.21		

MTCASat Background Calculations

26.3

30.3

30.7

31.4

31.5

32.4

37.4

39.4

39.6

39.7

41

42.2

43.8

47.1

47.95

49.4

56.4

58.3

75.4

77.9

82.3

Zn - GROUP "E"

REGIONS J,L,P,R - EASTERN WASHINGTON

Number of samples		Uncensored values			
Uncensored	21	Mean	45.74		
Censored	0	Lognormal mean	45.73		
TOTAL	21	Std. devn.	16.11		
		Median	41		
		Min.	26.3		
		Max.	82.3		
Lognormal distribution?		Normal distribution?			
r-squared is: 0.95		r-squared is: 0.87			
Recommendations:					
Use lognormal distribution.					
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:			
L	90	67.47			
L = lognormal	50th	43.40			
N = normal	4 X 50th	173.60			
X = neither (so use nonparametric method)	Coefficient of Variation = 0.35				

MTCASat Background Calculations

* Ag - STATEWIDE

ALL DATA

** Background calculation based on values exceeding detection limit*

Number of samples		<u>Uncensored values</u>					
Uncensored	33	Mean	0.43				
Censored	0	Lognormal mean	0.43				
TOTAL	33	Std. devn.	0.13				
		Median	0.37				
		Min.	0.24				
		Max.	0.75				
Lognormal distribution?		Normal distribution?					
r-squared is: 0.91		r-squared is: 0.84					
Recommendations:							
Use lognormal distribution.							
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:				
L		90	0.61				
L = lognormal		50th					
N = normal		4 X 50th					
X = neither (so use nonparametric method)		Coefficient of Variation = 0.31					

MTCASStat Background Calculations
BARIUM DATA

47.6

49.2

67.9

89.3

92.9

94.4

95.1

96.6

98

103

104

104

109

116

116

116

118

120

122

132

133

135

136

140

141

144

145

147

148

149

153

154

155

157

158

159

159

162

168

170

175

178

178

179

181

183

184

186

189

189

190

191

192

193

194

194

197

199

201

202

209

Ba - SPOKANE BASIN

ALL DATA

Number of samples	Uncensored values								
Uncensored	72	Mean	164.29						
Censored	0	Lognormal mean	164.87						
TOTAL	72	Std. devn.	63.96						
		Median	157.5						
		Min.	47.6						
		Max.	471						
Lognormal distribution?		Normal distribution?							
r-squared is: 0.95		r-squared is: 0.87							
Recommendations:									
Use lognormal distribution.									
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:						
L		90	254.97						
L = lognormal		50th	153.28						
N = normal		4 X 50th	613.11						
X = neither (so use nonparametric method)		Coefficient of Variation = 0.41							

**NOTE: Ba DATA COLLECTED IN SPOKANE BASIN ONLY. BACKGROUND VALUE
MAY NOT BE REPRESENTATIVE OF STATEWIDE CONCENTRATIONS.**

MTCASat Background Calculations
BARIUM DATA

210
213
232
242
266
280
293
326
471

MTCASat Background Calculations
CALCIUM DATA

Ca - SPOKANE BASIN

ALL DATA

Number of samples		<u>Uncensored values</u>					
Uncensored	72	Mean	9185.53				
Censored	0	Lognormal mean	5216.31				
TOTAL	72	Std. devn.	28877.71				
		Median	3265				
		Min.	888				
		Max.	180000				
Lognormal distribution?		Normal distribution?					
r-squared is: 0.63		r-squared is: 0.23					
Recommendations:							
Use nonparametric method.							
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:				
X		90	5493.00				
L = lognormal			50th 3210.00				
N = normal			4 X 50th 12840.00				
X = neither (so use nonparametric method)			Coefficient of Variation = N/A				

**NOTE: Ca DATA COLLECTED IN SPOKANE BASIN ONLY. BACKGROUND VALUE
MAY NOT BE REPRESENTATIVE OF STATEWIDE CONCENTRATIONS.**

888

1400

1600

1850

1880

1880

1920

2020

2030

2040

2100

2120

2120

2150

2150

2160

2190

2190

2220

2280

2290

2320

2340

2350

2360

2380

2480

2490

2520

2660

2800

2880

3000

3120

3160

3260

3270

3340

3350

3380

3450

3460

3520

3660

3700

3710

3720

3760

3850

3890

3900

3930

3940

3980

4040

4050

4120

4220

4240

4450

4450

4480

4550

MTCASStat Background Calculations
CALCIUM DATA

4810
5290
5580
6730
7140
13800
117000
135000
180000

MTCASat Background Calculations
COBALT DATA

3.29

3.47

3.95

4.87

5.06

5.31

5.38

5.45

5.47

5.49

5.5

5.56

5.68

5.85

5.94

5.94

6.01

6.05

6.24

6.41

6.42

6.49

6.55

6.57

6.58

6.67

6.72

6.76

6.98

7

7.05

7.07

7.15

7.29

7.33

7.36

7.37

7.39

7.43

7.45

7.59

7.64

7.75

7.9

8.15

8.32

8.38

8.4

8.5

8.63

8.64

8.65

8.7

8.81

8.91

9.11

9.19

9.72

9.91

10.2

10.3

10.3

10.5

Co - SPOKANE BASIN

ALL DATA

Number of samples	<u>Uncensored values</u>				
Uncensored	72	Mean	7.82		
Censored	0	Lognormal mean	7.82		
TOTAL	72	Std. devn.	2.52		
		Median	7.365		
		Min.	3.29		
		Max.	19.2		
Lognormal distribution?		Normal distribution?			
r-squared is: 0.98		r-squared is: 0.90			
Recommendations:					
Use lognormal distribution.					
Enter distribution (L, N or X)		Enter percentile			
L		90	Value corresponding to that percentile is:		
L = lognormal		50th	11.15		
N = normal		4 X 50th	7.47		
X = neither (so use nonparametric method)		Coefficient of Variation = 0.32			

NOTE: Co DATA COLLECTED IN SPOKANE BASIN ONLY. BACKGROUND VALUE MAY NOT BE REPRESENTATIVE OF STATEWIDE CONCENTRATIONS.

MTCASat Background Calculations
COBALT DATA

**10.5
10.6
10.7
11.4
12.1
12.3
12.4
13.4
19.2**

MTCASat Background Calculations
MAGNESIUM DATA

72.8
 74.5
 75.8
 79
 85.9
 90.1
 91.7
 103
 104
 109
 109
 111
 112
 114
 116
 120
 121
 123
 124
 125
 126
 128
 128
 129
 129
 129
 134
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 162
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 188
 189
 189
 190
 193
 194
 201
 201
 201
 204
 206
 213
 215
 215
 219
 225
 225
 271
 278
 285
 298

Mg - SPOKANE BASIN
ALL DATA

Number of samples		Uncensored values					
Uncensored	69	Mean	244.01				
Censored	0	Lognormal mean	209.37				
TOTAL	69	Std. devn.	442.14				
		Median	176				
		Min.	72.8				
		Max.	3520				
Lognormal distribution?		Normal distribution?					
r-squared is: 0.78		r-squared is: 0.26					
Recommendations:							
Use nonparametric method.							
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:				
X		90	298.00				
L = lognormal		50th	175.00				
N = normal		4 X 50th	700.00				
X = neither (so use nonparametric method)		Coefficient of Variation = N/A					

NOTE: Mg DATA COLLECTED IN SPOKANE BASIN ONLY. BACKGROUND VALUE MAY NOT BE REPRESENTATIVE OF STATEWIDE CONCENTRATIONS.

MTCASat Background Calculations
MAGNESIUM DATA

354
368
397
468
1602
3520

MTCASat Background Calculations

* Sb - STATEWIDE

ALL DATA

* BACKGROUND CALCULATION BASED ON VALUES EXCEEDING DETECTION LIMIT

Number of samples		Uncensored values					
Uncensored	50	Mean	4.10				
Censored	0	Lognormal mean	4.10				
TOTAL	50	Std. devn.	0.87				
		Median	4				
		Min.	3.1				
		Max.	7.6				
Lognormal distribution?		Normal distribution?					
r-squared is: 0.91		r-squared is: 0.82					
Recommendations:							
Use lognormal distribution.							
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:				
L		90	5.20				
L = lognormal		50th	4.02				
N = normal		4 X 50th	16.10				
X = neither (so use nonparametric method)		Coefficient of Variation = 0.2					

MTCAS Stat Background Calculations

0.4
0.41
0.44
0.45
0.47
0.51
0.51
0.54
0.59
0.62
0.74
0.74
0.77
0.84

* SELENIUM

* STATEWIDE DATA - BACKGROUND CALCULATION BASED ON THOSE VALUES EXCEEDING DETECTION LIMIT ("AA" ANALYSIS)

Number of samples	Uncensored values							
	Uncensored	14	Mean	0.57				
Censored		0	Lognormal mean	0.57				
TOTAL		14	Std. devn.	0.15				
			Median	0.525				
			Min.	0.4				
			Max.	0.84				
Lognormal distribution?			Normal distribution?					
r-squared is: 0.95			r-squared is: 0.92					
Recommendations:								
Use lognormal distribution.								
Enter distribution (L, N or X)		Enter percentile		Value corresponding to that percentile is:				
L		90		0.78				
L = lognormal		50th		0.56				
N = normal		4 X 50th		2.23				
X = neither (so use nonparametric method)		Coefficient of Variation = 0.27						

MTCASat Background Calculations
TITANIUM DATA

131 **Ti - SPOKANE BASIN**
268
270
275
285
341 ALL DATA
349
429
439
440
442
451
452
463
466
507
516
518
518
519
540
558
560
561
576
579
583
588
589
596
598
612
624
625
628
631
632
633
642
642
651
655
659
665
666
680
693
700
707
723
741
741
747
749
749
753
781
796
823
839
846
872
900

Number of samples		Uncensored values			
Uncensored	72	Mean	681.60		
Censored	0	Lognormal mean	683.68		
TOTAL	72	Std. devn.	311.17		
		Median	631.5		
		Min.	131		
		Max.	2130		
Lognormal distribution?		Normal distribution?			
r-squared is: 0.94		r-squared is: 0.82			
Recommendations:					
Use lognormal distribution.					
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:			
L	90	1109.73			
L = lognormal	50th	623.62			
N = normal	4 X 50th	2494.48			
X = neither (so use nonparametric method)	Coefficient of Variation = 0.47				

NOTE: Ti DATA COLLECTED IN SPOKANE BASIN ONLY. BACKGROUND VALUE MAY NOT BE REPRESENTATIVE OF STATEWIDE CONCENTRATIONS.

MTCASat Background Calculations
TITANIUM DATA

903
910
1120
1270
1290
1320
1370
1550
2130

MTCASStat Background Calculations
VANADIUM DATA

8.23

12.6

13.4

14.1

14.9

15

15.1

15.3

15.9

16.6

17

17.4

17.9

18

18

18.3

18.3

18.6

19.2

19.6

19.6

19.7

19.8

19.9

20.1

20.8

21.5

21.6

21.9

22

22

22.6

23.1

23.3

23.7

24.8

25.3

25.7

25.9

26.5

26.6

26.8

27.3

27.6

27.6

27.7

29.4

30

31.6

32.1

32.3

33.3

33.8

34.7

35.3

36.2

37

37.6

38.8

V - SPOKANE BASIN

ALL DATA

Number of samples		<u>Uncensored values</u>					
Uncensored	72	Mean	28.15				
Censored	0	Lognormal mean	28.06				
TOTAL	72	Std. devn.	13.57				
		Median	24.25				
		Min.	8.23				
		Max.	80.5				
Lognormal distribution?		Normal distribution?					
r-squared is: 0.98		r-squared is: 0.86					
Recommendations:							
Use lognormal distribution.							
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:				
L		90	45.04				
L = lognormal		50th	25.56				
N = normal		4 X 50th	102.25				
X = neither (so use nonparametric method)		Coefficient of Variation = 0.46					

NOTE: VANADIUM DATA COLLECTED IN SPOKANE BASIN ONLY. BACKGROUND VALUE MAY NOT BE REPRESENTATIVE OF STATEWIDE CONCENTRATIONS.

MTCASStat Background Calculations
VANADIUM DATA

39
39.4
40.2
42.3
43.1
48.5
49.4
57
59.8
60.2
66.2
80.5

XII. DATA QUALITY INFORMATION

Data Quality Assurance and Quality Control (QA/QC)

Information on the overall quality of the data used in this report is presented in this section. The background soil data presented in this report is based on analytical work performed by the Department of Ecology's Manchester Environmental Laboratory. Four primary methods or procedures are employed by Manchester to evaluate and control the accuracy of laboratory analyses: check standards, duplicates, spikes, and blanks. The check standard is routinely performed in the laboratory using lab control samples and spiked blanks. The most important of the quality control measures is the check standard, followed by duplicate samples.

Sample Splits, Duplicates, and Reference Samples

Sample splits, duplicates, and reference samples were periodically collected in each phase of this study. The sample preparation method outlined in ASTM D 3987-85 was used to prepare all sample splits and duplicates. In addition to sample splits and duplicates, reference samples were also collected. Reference samples were collected from a separate geographic location and included in another data set for analysis. For example, the two reference samples in the Puget Sound data base were actually collected in Walla Walla. These samples were labeled as coming from the Puget Sound data set for QA/QC purposes. Additional information on sample splits and duplicates is given in Table 18.

Table 18: Sample Splits, Duplicates, and Reference Samples

Study	Date	Sampling Locations	Splits	Duplicates	Reference Samples	Total No. Samples
Soos Creek	1987	18	0	4		41
Other Regions ¹	1990	35	0	0		35
Clark County ²	1991	26	5	0	2	86
Yakima ³	1991	32	7	0	2	117
Spokane ⁴	1992	27	9	0		84
Puget Sound ⁵	1993	28	6	4	2	127
	Total =	166	27	8	6	490

¹Regions "A", "C", "D", "J", "L", "P", "R"

²Includes Region "G"

³Includes Region "M", "O"

⁴Includes Region "U"

⁵Includes Region "F"

Laboratory Precision and Accuracy

In order to assess the quality of the data, relative percent difference calculations on the relative percent difference (RPD) for each sample split, duplicate, or "reference" sample is presented in this section. The RPD for each sample was calculating using the following formula:

$$\text{Relative Percent Difference (RPD)} = ((A-B)/(A+B))/2 \times 100 = (\%)$$

For example, sample "A" has a value of 16 mg/kg. Sample "B," which is a duplicate, has a value of 13.9 mg/kg. The RPD in this case is:

$$RPD = ((16-13.9)/(16+13.9))/2 \times 100 = 3.5\%$$

RPD values were not calculated if a laboratory detection limit value was reported for one or both samples.

Data Quality Results

RPD calculations for each sample split, duplicate, or reference sample is given in Table 18. The overall quality of the data was excellent-- the average relative percent difference for all sample splits, duplicates, or reference samples was 4%. The median relative percent difference value for each of the 12 elements was less than 6%. The RPD values were highest for the two elements cadmium and mercury. This variance can probably be attributed to the presence of both elements at concentrations that are at or near laboratory detection limits.

Analytical Effects - Arsenic

During the compilation of data for this study, it was noted that at lower levels (i.e., less than 50 mg/kg), the arsenic values produced by inductively coupled plasma atomic emission spectroscopy (ICP) were significantly higher than those produced by atomic absorption (AA). The effect of AA vs. ICP upon the Puget Sound Basin, Spokane, Clark County, and Yakima Basin data sets is graphically illustrated in Figures 49-52. ICP analysis can produce higher values for arsenic because of iron (iron acts as an interferant and is difficult to correct for when analyzing for arsenic using ICP methods). In contrast to ICP, AA analysis has a much lower detection limit (when analyzing for arsenic in soil, the Ecology Manchester Laboratory uses a detection limit of 0.15 mg/kg for GFAA and 3 mg/kg for ICP analysis) and is thus much more accurate than ICP at lower levels. Thus, it is important to be aware of this issue when analyzing for arsenic.

Quality Assurance Memos

Information on sample receipt, instrument calibrations, procedural blanks, spiked samples, and serial dilutions were summarized in "quality assurance" memos prepared by Manchester laboratory. An example quality assurance memo is included on p. 12-12.

TABLE 19: RELATIVE PERCENT DIFFERENCE SUMMARY STATISTICS (PER ELEMENT)

	Al	As - AA	As - ICP	Be	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Zn
MAX	11.9%	50.0%	28.3%	12.3%	30.9%	9.1%	21.0%	15.2%	18.9%	16.0%	38.9%	13.1%	6.0%
MEAN	2.7%	5.6%	6.9%	2.4%	7.5%	2.1%	3.1%	1.9%	5.3%	3.3%	8.2%	2.7%	1.4%
MEDIAN	1.9%	2.1%	6.0%	1.6%	5.9%	1.6%	1.2%	1.3%	3.3%	2.4%	5.0%	2.0%	0.9%
MIN	0.0%	0.0%	0.0%	0.0%	0.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
(n) =	38	31	33	37	24	38	38	38	33	38	36	38	38

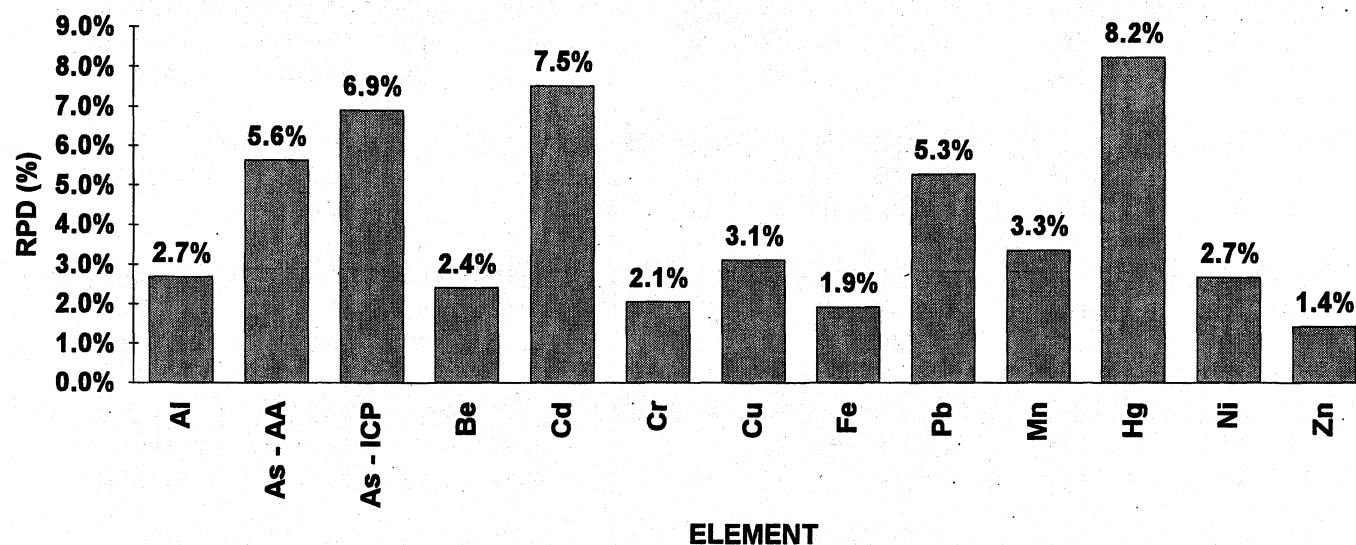
FIGURE 48: MEAN RELATIVE PERCENT DIFFERENCE PER ELEMENT

TABLE 20: RELATIVE PERCENT DIFFERENCES, SAMPLE SPLITS, DUPLICATES, AND REFERENCE SAMPLES

SITE	SAMPLE NO.	AI	As - AA	As - ICP	Be	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Zn	MEAN RPD (%)
CL112.2	91238180	32,400	3.31	22.0	1	1	26	15	33,500	8	562	0	17	64	
CL312.2.3SS	91258446	30,400			1	1	23	14	34,100	4	827	0	15	57	
	RPD =	2%			1%	7%	2%	2%	0%	19%	10%	7%	2%	3%	5%
CL140.3	91238185	25,600	3.89	22.0	2	1	19	23	34,300	54	536	0	12	80	
CL280.3SS	91238209	25,400	4.95	48.9	2	1	21	56	39,200	25	529	0	13	78	
	RPD =	0%	6%	19%	1%	13%	2%	21%	3%	19%	0%	39%	2%	0%	10%
CL150.3	91238187	53,500	2.64	38.3	2	1	29	22	48,800	10	434	0	21	74	
CL282.2SS	91238210	42,500	3.35	59.3	2	1	26	22	46,200	8	420	0	14	64	
	RPD =	6%	6%	11%	2%	2%	3%	0%	1%	6%	1%	7%	9%	4%	4%
CL182.2	91258505	45,100	3.14	37.1	2	1	31	18	37,500	11	1370	0	19	89	
CL292.2SS	91258510	44,700	2.90	31.9	1	1	29	18	37,600	7	1310	0	20	87	
	RPD =	0%	2%	4%	0%	1%	1%	0%	0%	10%	1%	0%	1%	1%	2%
CL240.3		38,800			2	1	17	20	52,900	10	986	0	19	99	
CL300.3SS	91258447	37,700			2	1	18	20	52,100	9	1100	0	17	99	
	RPD =	1%			4%	9%	2%	1%	0%	2%	3%	5%	3%	0%	3%
CL270.3RS	91258520	19,200	2.80	18.0	1	1	25	10	16,500	5	258	0	26	29	
CL272.2RS	91258521	19,500	2.70	15.0	1	0	24	10	16,500	4	247	0	28	30	
	RPD =	0%	1%	5%	2%	7%	0%	1%	0%	7%	1%	1%	2%	1%	2%
PSL3A0.5	87278105	22,800		18	1	<.8	19	18	15,300	<4	373	0	21	40	
PSL5AO.5DUP	91258522	21,800		19	1	<.8	19	27	17,000	<4	412	0	21	42	
	RPD =	1%		1%	0%		0%	10%	3%		2%	1%	0%	1%	2%
PSL6A0.5	87278111	15,700		<11	1	<.8	26	13	14,200	<4	231	0	25	31	
PSB8AO.5DUP	87278147	14,500		<11	<.5	8	18	10	13,500	<4	215	0	22	28	
	RPD =	2%					9%	7%	1%		2%	7%	3%	3%	4%
PSB2A0.5	87278113	21,900		12	1	<.8	24	13	17,000	<4	494	0	23	39	
PSB6AO.5DUP	87278145	23,000		<11	1	<.8	22	12	17,000	<4	255	0	23	39	
	RPD =	1%					2%	2%	0%		16%	6%	0%	0%	3%
PSB4A2.0	87278142	28,300		15	1	<.8	24	8	11,300	<4	137	0	19	27	
PSB7A2.0DUP	87278146	25,000		<11	1	<.8	20	8	10,300	<4	122	0	16	26	
	RPD =	3%			5%		5%	0%	2%		3%	1%	4%	1%	3%

TABLE 20: RELATIVE PERCENT DIFFERENCES, SAMPLE SPLITS, DUPLICATES, AND REFERENCE SAMPLES

SITE	SAMPLE NO.	AI	As	AA	As-ICP	Be	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Zn	MEAN RPD (%)
PS10.3	93088519	24,000	7	27	1	1	34	32	28,700	16	1210	0	30	60		
PS300.3DUP	93088637	21,000	6	20	1	<0.2	31	29	27,400	13	1090	0	25	55		
	RPD =	3%	4%	7%	2%		2%	3%	1%	5%	3%	2%	4%	2%	3%	
PS12.2	93088520	21,700	6	20	0	1	36	30	27,300	6	819	0	30	44		
PS302.2DUP	93088638	16,700	6	19	0	<0.2	33	25	25,500	6	972	0	23	41		
	RPD =	7%	1%	1%	1%		2%	4%	2%	1%	4%	3%	7%	2%	3%	
PS20.3	93088522	14,600	3	15	0	0	20	16	17,700	7	654	0	21	65		
PS270.3DUP	93088631	13,400	2	12	0	<0.2	18	15	15,800	6	637	0	18	65		
	RPD =	2%	5%	6%	1%		2%	1%	3%	1%	1%	7%	5%	0%	3%	
PS22.2	93088523	17,300	6	23	0	1	31	16	28,200	5	459	0	23	45		
PS272.2DUP	93088632	11,400	4	17	0	<0.2	22	10	20,400	4	342	0	13	35		
	RPD =	10%	11%	8%	12%		8%	10%	8%	6%	7%	6%	13%	6%	9%	
PS40.3V	93088527	20,600	9	28	0	1	48	40	36,600	18	663	0	54	109		
PS320.3SS	93088641	19,700	10	31	0	0	45	39	33,400	16	586	0	48	100		
	RPD =	1%	3%	2%	1%		31%	1%	0%	2%	3%	3%	2%	3%	2%	
PS70.3C	93088552	10,400	4	10	0	0	19	16	16,400	8	315	0	18	43		
PS310.3SS	93088639	10,300	5	13	0	<0.2	20	18	15,900	10	316	0	17	45		
	RPD =	0%	1%	7%	3%		2%	2%	1%	5%	0%	7%	1%	1%	2%	
PS122.2	93088578	18,800	2	8	0	<0.2	24	11	16,200	5	172	0	27	27		
PS292.2SS	93088636	14,500	2	10	0	<0.2	25	9	13,000	3	138	0	26	23		
	RPD =	6%	2%	6%	1%		1%	4%	5%	14%	5%	10%	1%	4%	5%	
PS154.3V	93088588	17,300	3	4	0	<0.2	16	19	18,000	4	227	0	19	36		
PS312.2SS	93088640	18,400	2	13	0	<0.2	18	18	18,200	3	249	0	21	35		
	RPD =	2%	2%	2%	7%		3%	1%	0%	7%	2%	13%	2%	1%	6%	
PS282.2SS	93088634	23,400	4	20	0	<0.2	23	14	27,800	7	287	0	15	54		
PS1855	93088603	14,400	2	14	0	<0.2	22	22	25,200	8	217	0	15	50		
	RPD =	12%	20%	9%	10%		1%	12%	2%	1%	7%	10%	1%	2%	7%	
PS200.3A	93088612	12,900	14	26	0	0	24	16	12,300	46	621	0	27	49		
PS290.3SS	93088635	13,300	6	19	0	0	19	15	11,400	42	519	0	27	48		

TABLE 20: RELATIVE PERCENT DIFFERENCES, SAMPLE SPLITS, DUPLICATES, AND REFERENCE SAMPLES

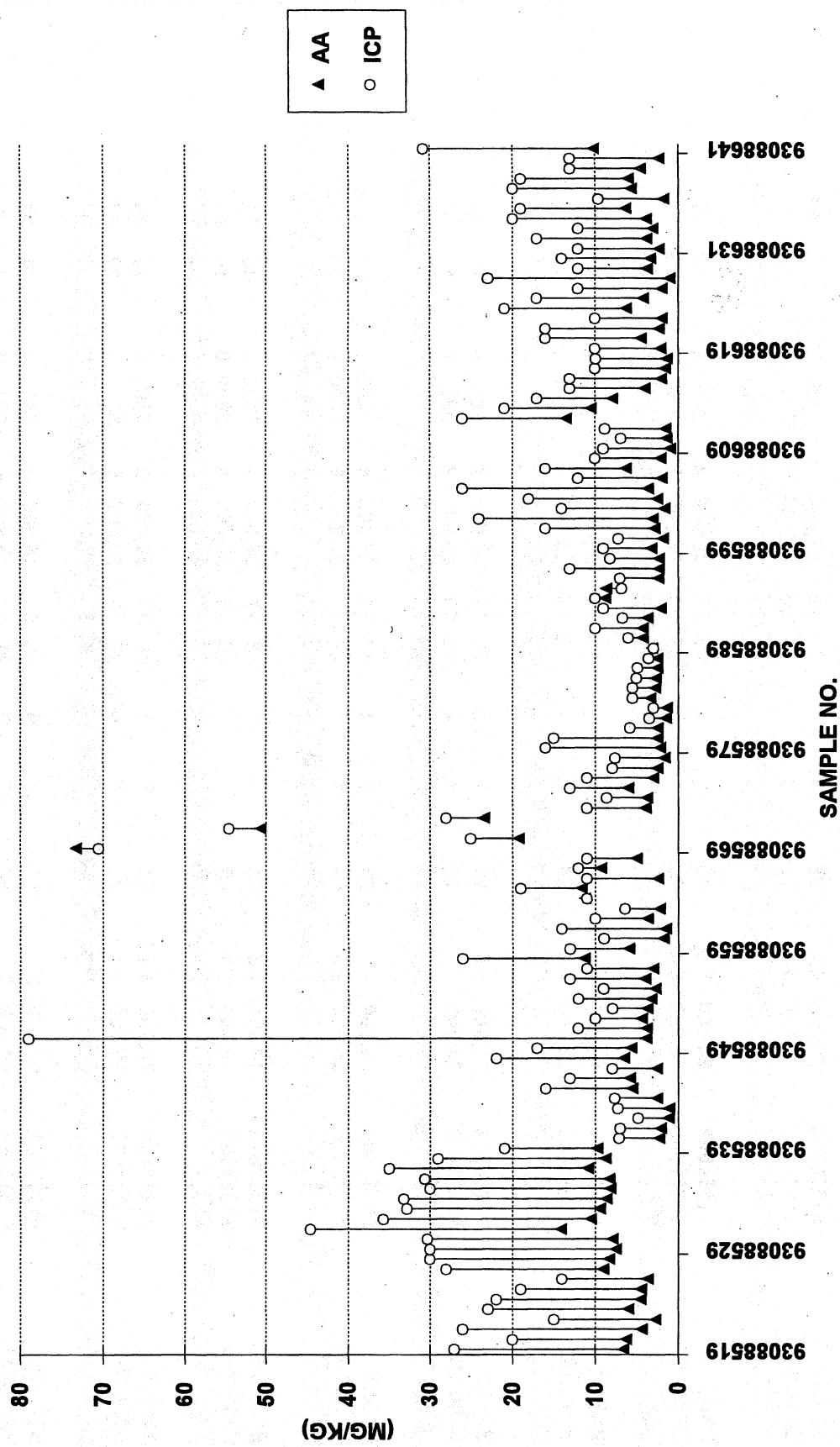
SITE	SAMPLE NO.	AI	As - AA	As - ICP	Be	Cd	Cf	Cu	Fe	Pb	Mn	Hg	Ni	Zn	MEAN RPD (%)
	RPD =	1%	18%	8%	0%	2%	6%	1%	2%	2%	4%	5%	0%	0%	4%
PS260.3RS	93088629	9,330	4	12	0	<0.2	9	17	21,900	6	420	0	11	48	
PS262.2RS	93088630	8,610	3	14	0	<0.2	9	16	21,400	6	402	0	10	48	
	RPD =	2%	3%	4%	1%	1%	6%	1%	1%	1%	1%	1%	1%	1%	2%
SB10.3	92268500	9,070	3.59	7.8	0	1	7	14	15,700	8	364	0	7	47	
SB330.3SS	92268574	9,570	3.15	12.0	0	0	7	13	16,500	8	353	0	8	50	
	RPD =	1%	2%	11%	1%	4%	2%	2%	1%	1%	1%	1%	1%	1%	2%
SB12.2	92268501	7,940	5.22	8.7	0	0	6	15	19,400	5	369	0	8	42	
SB320.3SS	92268573	9,155	4.15	12.0	0	1	6	15	22,000	6	378	0	10	46	
	RPD =	4%	6%	9%	0%	5%	10%	2%	0%	3%	3%	1%	3%	3%	6%
SB20.3	92268502	15,800	3.92	10.0	1	0	7	15	14,600	15	443	0	8	55	
SB340.3SS	92268575	17,100	3.72	15.0	1	0	8	14	15,400	15	435	0	9	56	
	RPD =	2%	1%	10%	2%	1%	1%	1%	1%	1%	1%	1%	1%	1%	2%
SB32.2	92268505	14,500	9.87	17.0	1	1	10	14	22,900	13	526	0	10	54	
SB270.3 SS	92268568	17,600	9.92	24.0	1	1	11	15	24,500	14	520	<0.005	11	59	
	RPD =	5%	0%	9%	2%	3%	3%	1%	2%	2%	2%	0%	1%	1%	2%
SB60.3	92268511	12,200	3.21	9.7	1	0	11	7	13,200	10	730	0	11	59	
SB290.3SS	92268570	14,500	3.03	15.0	1	0	11	8	14,300	10	1170	0	12	66	
	RPD =	2%	1%	11%	1%	3%	1%	1%	1%	1%	1%	1%	1%	1%	5%
SB80.3	92268517	15,500	5.82	17.0	1	1	11	12	13,400	17	488	0	9	56	
SB310.3SS	92268572	16,000	5.90	14.0	1	1	11	12	13,400	18	452	0	10	57	
	RPD =	4%	1%	0%	5%	3%	1%	0%	0%	1%	2%	4%	3%	3%	2%
SB111.3	92268525	18,800	7.95	20.0	1	1	13	19	37,800	12	777	0	13	60	
SB350.3SS	92268576	15,900	8.27	19.0	1	1	13	36	20,200	15	456	0	13	59	
	RPD =	4%	1%	1%	1%	3%	0%	15%	15%	6%	13%	24%	1%	0%	7%
SB130.3	92268529	24,200	3.46	19.0	1	1	19	17	22,300	10	550	0	16	52	
SB300.3SS	92268571	23,900	2.30	13.0	1	0	18	17	21,800	12	656	0	15	52	
	RPD =	0%	10%	9%	1%	1%	10%	1%	1%	1%	5%	4%	1%	1%	3%
SB142.2V	92268536	13,800	2.30	14.0	1	0	11	17	13,100	8	381	0	10	38	

TABLE 20: RELATIVE PERCENT DIFFERENCES, SAMPLE SPLITS, DUPLICATES, AND REFERENCE SAMPLES

SITE	SAMPLE NO.	Al	As - AA	As - ICP	Be	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Zn	MEAN RPD (%)
SB280.3SS	92268569	14,800	2.40	11.0	1	0	11	17	14,200	11	397	<0.005	11	44	
	RPD =	2%	1%	6%	2%	3%	1%	0%	2%	7%	1%	2%	4%	4%	3%
YB50.3V	91258574	14,200	4.6	26	1	0	13	18	25,400	11	465	0	13	55	
	91258582	13,700	4.4	29	1	1	13	18	25,100	11	470	0	15	56	
YB60.3	91258562	23,000	5.4	33	1	0	29	23	35,600	8	875	0	37	73	
	91258569	26,000	5.4	33	1	1	32	24	37,400	7	876	0	38	79	
YB90.3C	91258578	23,700	1.7	33	1	1	13	17	34,900	<2	1350	0	13	51	
	91258583	23,500	1.8	30	1	1	11	18	34,900	2	1160	0	12	50	
YB110.3	91258544	21,000	1.5	20	1	0	11	17	20,900	5	501	0	9	44	
	91258412	24,200		20	1	0	12	20	22,000	3	397	0	11	39	
YB130.3	91258404	28,100		23	1	1	27	16	27,100	5	1250	0	35	113	
	91258408	26,100	2.9	40	1	1	27	17	27,200	8	1540	0	35	115	
YB140.6V	91258546	18,400	1.5	34	1	1	15	17	38,000	5	1600	0	15	62	
	91258551	18,400	1.3	30	1	1	15	16	35,900	4	2000	0	16	61	
YB160.3	91258406	24,200	3.12	35	1	1	29	19	20,400	5	539	0	23	45	
	91258409	19,800	2.1	21	1	<0.2	28	16	20,000	8	554	0	22	44	
YB370.3RS	91258444	18,100	3	17	1	0	25	9	16,000	4	265	0	26	30	
	91258445	19,500	3	17	1	0	27	10	16,900	4	273	0	27	31	
YB372.2RS	RPD =	2%	0%	0%	1%	1%	1%	1%	1%	0%	1%	2%	1%	1%	1%
	MEAN RELATIVE PERCENT DIFFERENCE (ALL SAMPLES) =														4%

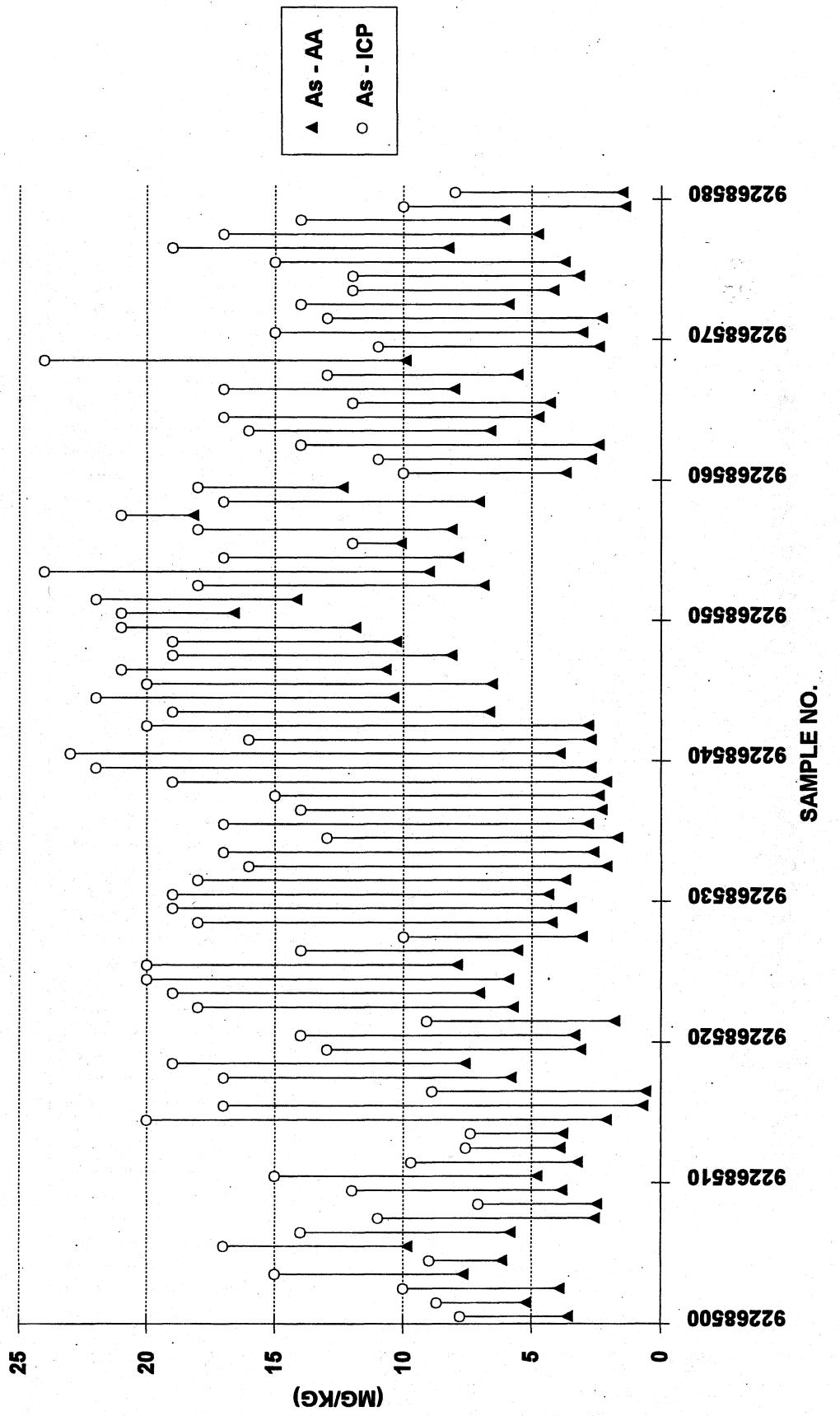
NOTE: CHART BASED ON 121 SAMPLES COLLECTED DURING 1993.

FIGURE 49: PUGET SOUND BASIN AA vs. ICP ARSENIC SAMPLES



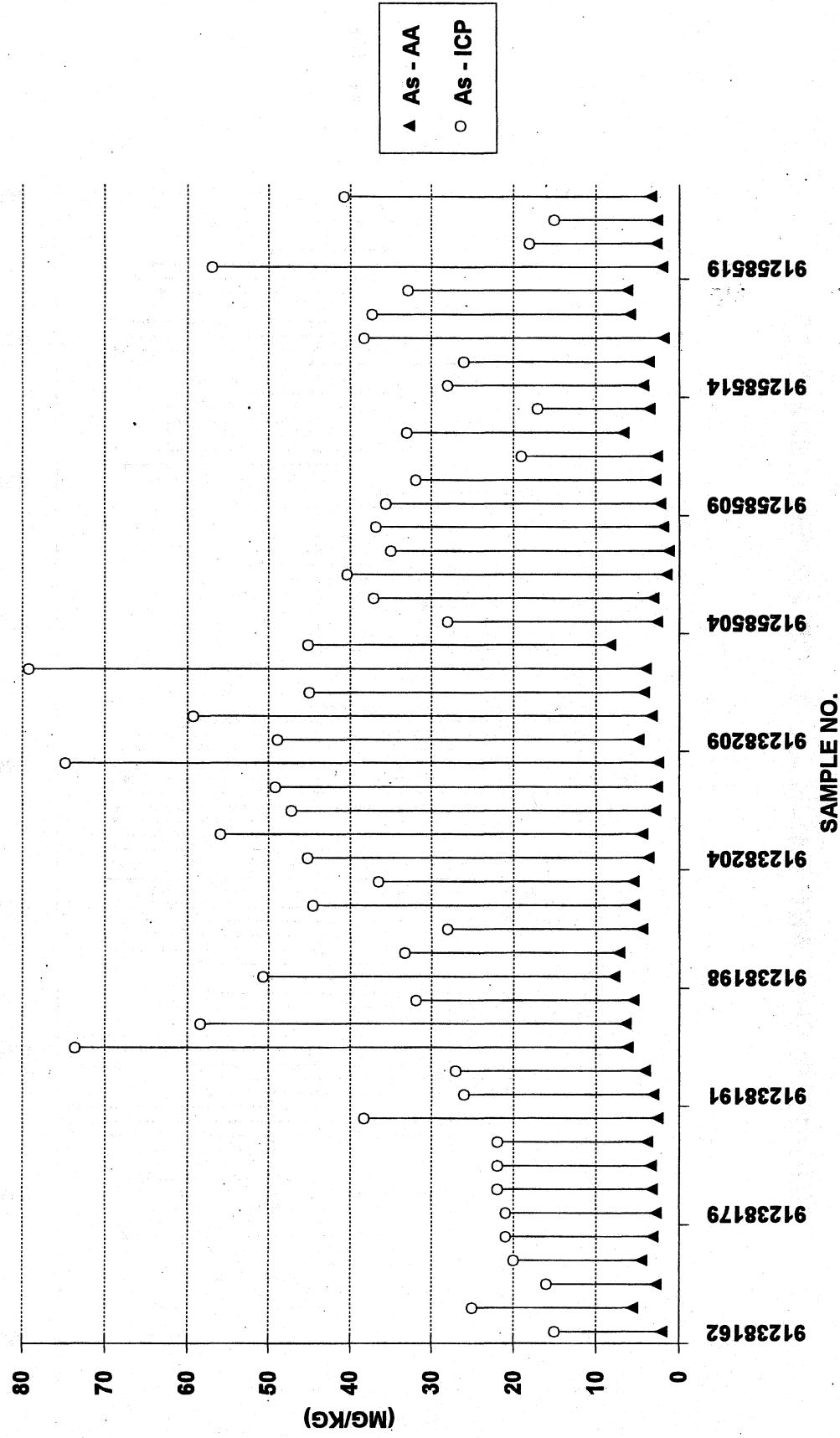
NOTE: CHART BASED ON 81 SAMPLES COLLECTED DURING 1992.

FIGURE 50: SPOKANE BASIN AA vs. ICP ARSENIC SAMPLES



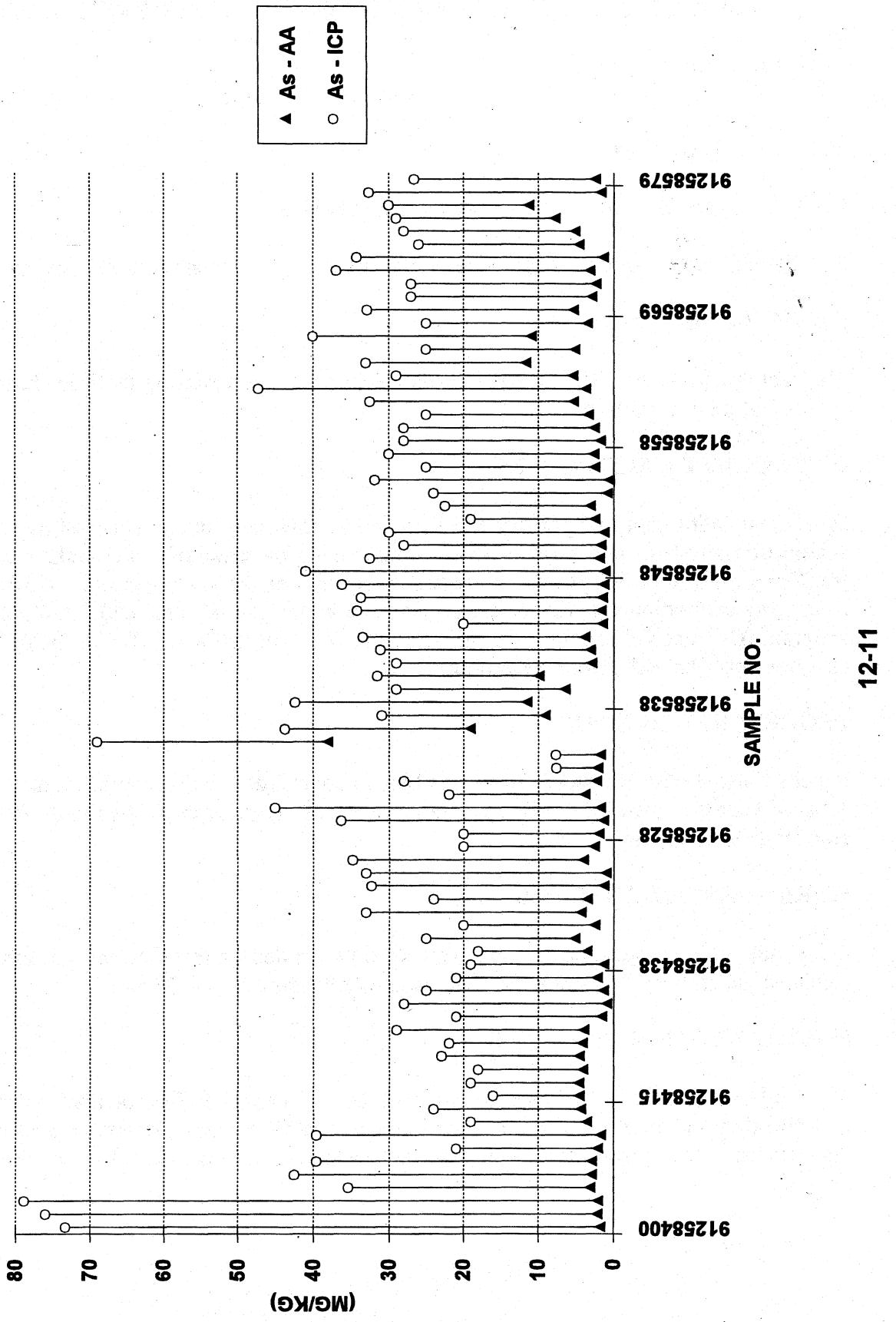
NOTE: CHART BASED ON 49 SAMPLES COLLECTED DURING 1991.

FIGURE 51: CLARK COUNTY AA vs ICP ARSENIC SAMPLES



NOTE: CHART BASED ON 84 SAMPLES COLLECTED DURING 1991.

FIGURE 52: YAKIMA BASIN AA VS. ICP ARSENIC SAMPLES



EXAMPLE QUALITY ASSURANCE MEMO - MANCHESTER LABORATORY

November 1992

TO: Pete Kmet

FROM: Bill Kammin, Environmental Lab Director

SUBJECT: Metals Quality Assurance memo for the 1992 Metals in Soils Project

SAMPLE RECEIPT

The samples from the 1992 Metals in Soils project were received by the Manchester Laboratory on 6/18/92 in good condition.

INSTRUMENT CALIBRATION

Instrument calibration was performed before each analytical run and checked by initial calibration verification standards and blanks. Continuing calibration standards and blanks were analyzed at a frequency of 10% during the run and again at the end of the analytical run. All initial and continuing calibration verification standards were within the relevant USEPA Contract Laboratory Program (CLP) control limits. AA calibration gave a correlation coefficient (*r*) of 0.995 or greater, also meeting CLP calibration requirements.

PROCEDURAL BLANKS

Results flagged with B denote procedural blank contamination. Procedural blank problems were generally at ultra-trace levels. Blank contamination at these levels is commonly found in total recoverable digestions.

SPIKED SAMPLE ANALYSIS

Spike and duplicate spike sample analyses were performed on this data set. Results qualified with N denote spike recoveries outside the CLP acceptance limits of +/- 25%.

SERIAL DILUTION ANALYSES

Serial dilution is used in ICP analyses to examine sample results for potential interferences. Results not meeting CLP serial dilution specifications are qualified with E, denoting sample based interferences. The E qualifier is also used to denote results estimated for other sample based reasons.

SUMMARY AND DISCUSSION

Generally, the quality of the data provided is acceptable. Two representative data packages (one atomic absorption -- one ICP) were examined in exhaustive detail, to help assure project data quality. The detailed analysis of the entire data set for the total recoverable arsenic data showed 96% of all analytical quality control was in control, and 100% of calibration related (critical) QC was in control.

For the ICP data package examined in exhaustive detail (8/6/92 run), calibration blank related critical QC was in control for 132 of 135 (98%) Continuing Calibration Blank (CCB) results. The three results above the Instrument Detection Limit (IDL), are all below 4 ug/L, and are the result of carryover from a standard into the CCB. This carryover has no analytical significance, and results are not qualified as a result of this occurrence.

For ICP Continuing Calibration Verification (CCV) results, 100% of the critical QC data was in control (166/166 results). In addition, for the ICSAB interference check standard, 100% (52/52) of the QC results were in control.

Although the other data sets in this data package were not examined in this exhaustive detail, normal QC review procedures indicate data of similar quality.

The data generated by the analysis of these samples can be used noting the data qualifications discussed in this memo.

Provided as an attachment to this memo is a compilation of qualifier definitions.

Please call Bill Kammin at SCAN 744-4737 to further discuss this project.

XIII. REFERENCES

- Alt, David D., and Hyndman, D.W. (1984). *Roadside Geology of Washington*. Mountain Press Publishing Company. Missoula, Montana, 282 p.
- Ames, Kenneth C. (1993). *Background Concentrations of Metals in Soils from Selected Regions in the State of Washington* (draft report, subject to revisions). U.S. Geological Survey Water Resources Investigation Report.
- Blakley, Nigel (1992). *Statistical Guidance for Ecology Site Managers*. Washington State Department of Ecology Publication 92-54.
- Blakley, Nigel (1993). *MTCAStat Statistical Software*. Published by the Washington State Department of Ecology, Toxics Cleanup Program.
- Bushnell, T.M. (1944). *The Story of Indiana Soils*, Purdue University Agricultural Experimental Station, Special Circulation 1, Lafayette, 52 p.
- Flint, R.F. (1971). *Glacial and Quaternary Geology*. John Wiley and Sons.
- Hunter, Fields, et.al. (1993). *A Summary of Selected Soil Constituents and Contaminants at Background Locations in New Jersey*. New Jersey Department of Environmental Protection.
- Jenny, Hans (1941). *Factors of Soils Formation*, McGraw-Hill Book Co., New York.
- Keller, W.D. (1957). *The Principles of Chemical Weathering*, Lucas Bros., Columbia, Missouri, 111 p.
- Lenfesty, C.D., and Reedy, T.E. (1985), *Soil Survey of Yakima County area, Washington*: U.S. Department of Agriculture Soil Conservation Service, Washington, D.C., 345 p.
- Ontario, Canada (1993). *Ontario Typical Range of Chemical Parameters in Soil, Vegetation, Moss Bags, and Snow*, Version 1.0a. Ontario Ministry of Environment and Energy.
- Poulson, E.N. (1953). *Soil Survey of Whatcom County Area, Washington*: U.S. Department of Agriculture Soil Conservation Service, Washington D.C., 153 p.
- Pringle, R.F. (1986). *Soil Survey of Grays Harbor County area, Pacific County, and Wahkiakum County, Washington*, U.S. Department of Agriculture Soil Conservation Service, Washington, D.C., 296 p.
- PTI Environmental Services (1989). *Background Concentrations of Selected Chemicals in Water, Soil, Sediments, and Air of Washington State*. Draft Report. Prepared for Washington Department of Ecology. Bellevue, WA.

- Reiche, P. (1950). A Survey of Weathering Processes and Products, Univ. of New Mexico, Univ. Albuquerque, Publs in Geology, 3, 95 p.
- Schaklette, H.T., and Boernogen, J.G. (1984). Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States. U.S. Geological Survey Professional Paper 1270.
- Slayton, D., and Montgomery, D. (1991). Michigan Background Soil Survey. Michigan Department of Natural Resources.
- Thornbury, William D. (1969). Principles of Geomorphology (Second Edition).
- Thornes, J.T. (1979) Process in Geomorphology. John Wiley and Sons, New York. Halsted Press.
- United States Department of Energy (1993). Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes, DOE/RL 92-24. U.S. Department of Energy, Richland Operations Office, Richland Washington.